

POPULAR SCIENCE

APRIL • 35c Monthly

Here
Come
**Turnpike
Trains**

PAGE 59

Solved: The
Wet-Basement
Problem

PAGE 133



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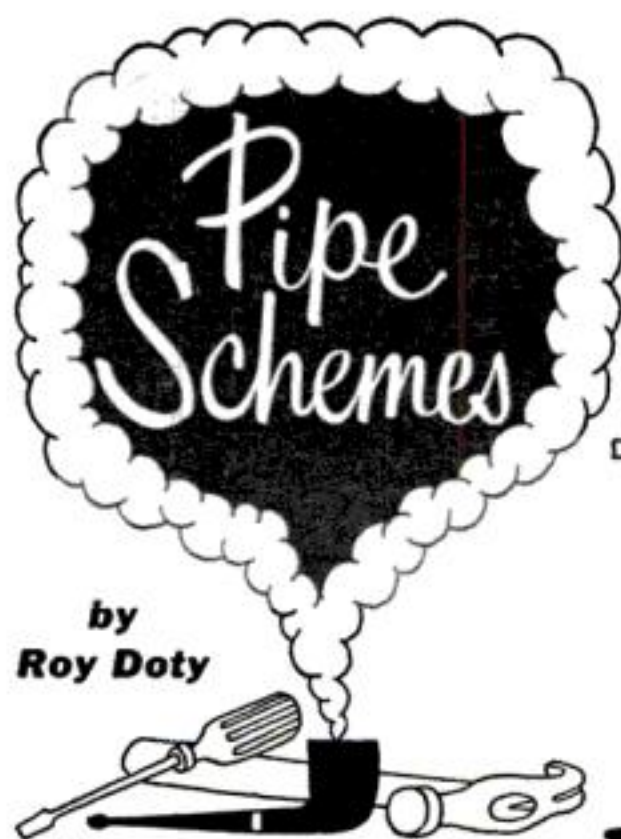
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Safe Driving: Will a kid pop out after that ball? P. 76

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Good Guy: His deadly double keeps him in trouble. P. 96

Founded in 1872 Vol. 176 No. 4

Mechanics and Handicraft REG. U. S. PAT. OFF.

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April, 1960

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America's Leading New-Idea Magazine for 88 Years

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PS Readers

TALK BACK



Is 49 Years a Record?

I WONDER how many of your readers go back to 1911 when I first started taking your most enlightening magazine. When I finished high school, I used parts of your articles in my graduation address. I hope you will continue publication of your delightful magazine for many, many more years.

C. H. BOUNDS, St. Petersburg.

Who can match or beat Reader Bounds' record as a member of the PS family?

The Corvair Brings Mail

How did you get an overall mileage figure of 10,360 on that rear-engine Chevy ["10,000 Miles in a Corvair," Jan.]? Your own figures by your separate writers total up to only 9,163.9.

JAMES W. WRIGHT, Whittier, Cal.

A glance at the table of consolidated figures will show how. Hundreds of additional miles had to be driven to obtain constant-speed and stop-go gas mileages. Various staff members also drove additional hundreds to round out the facts.

... IS THERE any practical method the Corvair owner can use to check the fan belt for 80-pound tension without running to the local dealer every 2,000 miles of operation?

CLAYTON D. RICHMAN, Chappell, Neb.

Insert a 16-inch screwdriver between idler pulley and engine block. Put a spring scale on the end of the handle. Pull rearward. On a used belt the tension is correct when the belt deflects 3/16 inch at a 25-pound pull, on a new belt at 40 pounds.

... WHEN you run a fan belt all over the car, and at constricting angles, and

it breaks—it's no "accident." Any teenager would know better than to try to run multiple and operable units off one twisted shoestring. (Bet you a used cigar it's changed in less than a year, it's so unworkable.)

How about praising the Ford Falcon with the same gusto—after you've found out what a really good little car it is?

L. J. MCCOY, W. Monroe, La.

He Takes a Look at the V-6

I HAVE just visited the local GMC branch to see their V-6 engine which you reported on last fall [Sept.]. I was amazed at its rugged construction. I have also learned that it makes about 1,200 r.p.m. less than a comparable V-8. All the parts are massive in size and I was intrigued to see the spark plugs up on top where they're easy to service and less subject to getting wet from the road.

Now I'd like to see articles about the new GMC independent front suspension, the new V-6 diesel engine, and the new tilt-cab series. How about it?

JAMES TABATA, Cleveland.

Why Can't an Air Sled Fly?

You say that if an air sled attained a fast enough forward speed ["Month in Science," Jan.], it would lift itself off its



supporting air bubble and crash. If an air sled has the power to lift itself off the air bubble, why can't it maintain steady flight?

JERRY BURT, Akron.

If the sled lifts itself off the air bubble, it lifts itself off its support. There's nothing left to keep it aloft—the bubble is

PUZZLE: FIND AL

Al's got himself lost in his job.

He does his work. He draws his pay. He gripes, and hopes, and waits. But the big breaks never seem to come.

You have to hunt hard for Al. He's in a rut!

Then, who's the figure standing out in the picture? That's Tom. Tom grew tired of waiting. He decided to act. He took three important steps:

1. Wrote to I.C.S. for their three famous career books.
2. Enrolled for an I.C.S. job-related course.
3. Started to apply—on the spot—what he was learning.

The others began to say, "Ask Tom, he knows." The supervisor began to take notice. The boss began to receive reports on Tom's progress. *And Tom began to move!*

It's a fact worth remembering: An I.C.S. student always stands out!

P.S.—You'll find men like Al everywhere—gripping, hoping, waiting—reading this and skipping on. But forward-looking fellows like Tom will take time to investigate, will mark and mail the coupon and get the three valuable career books free. They're men of action. And a few short months from now, you'll see them start to move!



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FOOD PROCESSOR: John Carroll, Milwaukee, Wisconsin. "We count on Firestones 100% to stop costly truck tire downtime and keep our food moving expenses in line!"



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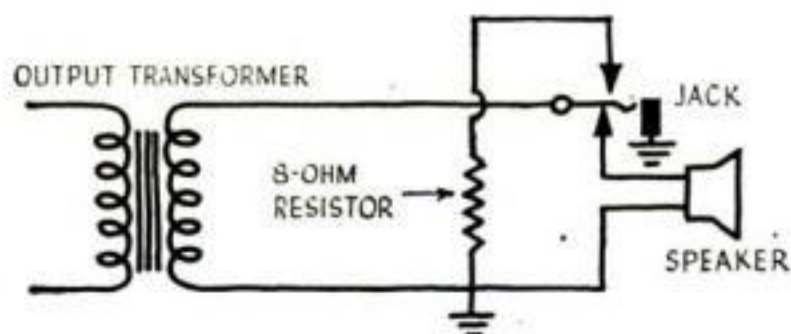


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gone and there are no wings for conventional flight. It's as though a man who couldn't swim walked off a dock.

Note for Rock-'n-Roll Dodgers

THE headphone jack for car radios [“Private Listening for Rock-'n-Rollers,” Jan.] is fine for conventional vacuum-tube radios. Owners of the newer cars should add a resistor and a different jack as shown in the diagram.



In radios with a *transistor* output stage, the transistor won't tolerate operation without some speaker or a suitable resistor. The voltages will swing excessively and possibly damage it. This could happen if you left the earphone in the jack accidentally and turned up the radio volume all the way to see if the set were working. The ordinary earphone doesn't require much in the way of power to make comfortable listening and therefore doesn't impose enough load on the output stage.

Maybe this will benefit someone else before he learns the hard way—as I did!

P. W. TERRELL, Columbus.

Good Samaritans of the Road

You say that a tourniquet should be used to stop bleeding [“If You're First on the Scene,” Dec.]. On the contrary, the American Red Cross says that a tourniquet improperly used can be more dangerous than the bleeding.

The best method is to use direct pressure on the point of bleeding. If a tourniquet must be used, it should not be released every 20 minutes as commonly believed. It should be released only by a doctor.

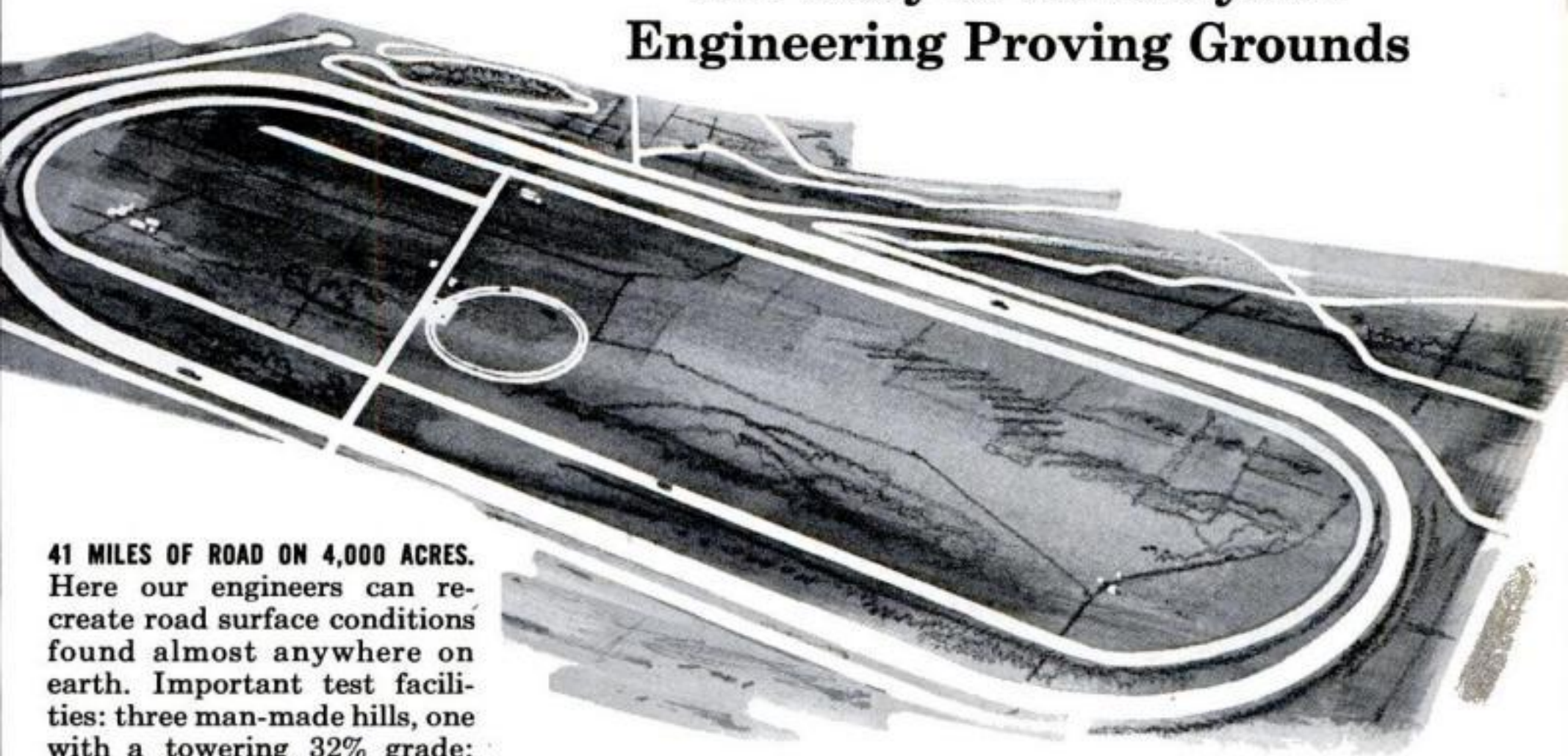
ARTHUR POPPER, NYC.

... AS THE First Aid Chairman of my county and member of an ambulance crew, I think the piece on what to do at the scene of a car accident was one of your best articles. But I'd like to correct the statement that a motorist is not legally required to stop. In Montana you must

CONTINUED

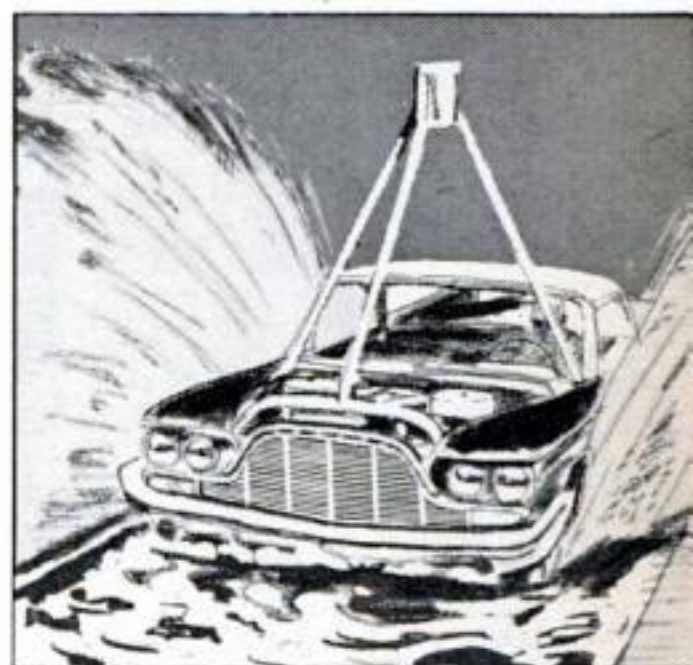
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stop or you are subject to a fine. I checked this with our State Highway Patrol.

DEAN V. WALSTON, Conrad, Mont.

For Sale: Compact Compact

THE baby Model T you showed in December "Picture News" is not a custom



job. It is manufactured in Georgia by the McDonough Equipment Company. I have the local dealership in my area.

G. M. TAYLOR, Oswego, N. Y.

Power from the Sun

CONGRATULATIONS on your superb ar-

ticle on the construction of a solar radio ["A Space-Age Crystal Set," Jan.]. This project was both interesting and practical and I am looking forward to building the set. Let's have more electronic projects.

J. C. SIMPSON JR., Alexandria, Va.

... THE CK722 transistor in the Space-Age crystal set is inserted backwards. The red dot is nearest the collector lead, not the emitter as in the pictorial diagram.

R. M. CLARK, Eatontown, N. J.

Thumbs Down on Sealed Bearings

HERE'S my two-cents' worth on the use of sealed bearings in Detroit cars:

The bearings in the last Chevy I owned (which received a constant flow of lubricant from the differential housing) were serving well at 118,000 miles. My current 1955 Chevy needed new rear-axle bearings at a mere 37,000 miles! Furthermore, a special press is required to replace the worn bearings, making it impossible for a man to do the job himself.

It becomes apparent that Detroit has progressively designed cars to wear out on

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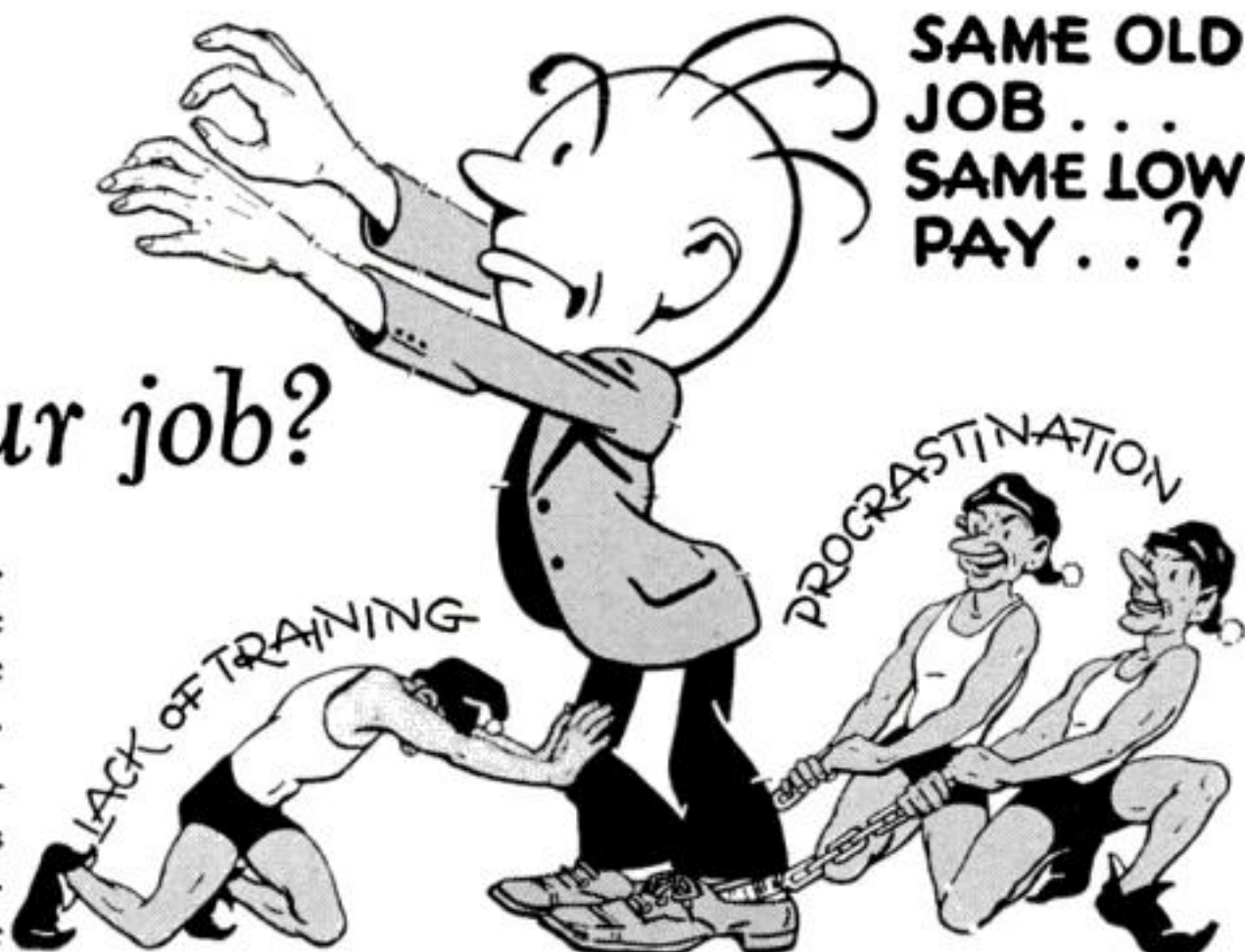
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schedule, to be more costly to repair, and to be so complicated that the average man can't begin to fix one. Congratulations to Rambler, Lark, VW, and others who are dedicated to keeping their cars simple, durable, and efficient, and satisfying to the owners.

R. N. NEIMAN, Oceanside, Cal.

His Problem's a Bird

I CAN appreciate reader Harry Tornquist's battle with the starlings ["PS Readers Talk Back," Feb.]. I'm having an all-season feud with some birds myself. His method of outwitting the big bullies so that the little birds get a chance at the feeder leads me to believe that he



might come up with something real ingenious for me. Please ask him: What has he got for pigeons? Somebody's flock is ruining my roof.

ERIC A. OLSEN, Cincinnati.

Who Tossed That Bottle?

THE Coast Guard gets enough credit for their work without being given credit for work done by the Coast and Geodetic Survey ["Have You Heard?" Dec.]. In "Operation Pop Bottle," the Coast Guard tossed no bottles in the ocean. It was the Coast and Geodetic Survey.

The Coast and Geodetic Survey is responsible for the surveys and charts boat owners the country over depend on.

V. P. CACKOWSKI, Tampa.

The Wandering Filter Screen

THE Model Garage story about the filter screen that wound up against the fuel-inlet hole [Jan.] was a good one. But when the bus wouldn't start, I think Gus went after the trouble backwards. Why didn't he remove the gas-line connection at the carburetor first? Then, by cranking the engine, he could have checked both gas lines and the fuel pump at once. If no gasoline was being pumped out, then he could have gone back on the lines and pump.

Anyway, how did the school bus ever

CONTINUED

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Home Office, West Haven, Connecticut

get to the lake if the filter screen was loose in the fitting since the day before? Wouldn't this have stopped the engine the first time it was started?

ROBERT CARLSON, Storm Lake, Iowa.

We'll have to concede that Gus did take the long way round to find the trouble. But there is no doubt that the bus could have made it to the lake. The filter screen was merely loose on the fuel-inlet fitting. It took 24 hours for it to work itself off the end.

Lubing Car-Door Rubber

IN "Hints from the Model Garage" [Jan.], you say the use of brake fluid on weatherstripping will prevent sticking. This may be true, but brake fluid is also a good paint remover.

IVAN E. LOFTIS JR., Columbus, Ohio.

The brake fluid is applied to the rubber with a rag, not doused over the car. The rubber absorbs the glycerine in the



fluid and the alcohol evaporates before it can do any harm to the finish. The careful worker will have no trouble.

... FOR many years I have been using paste wax on car-door rubber to prevent sticking. Wax is not so messy to remove if it gets on your clothing. It has another advantage in winter: Ice won't form on the rubber because water won't penetrate the wax.

A. A. LEVESQUE, Somerset, Mass.

Want to Treat a Gunstock?

Just picked up some news that may interest readers of my article on that mouthful: polyethylene glycol-1000 ["They've Licked Wood Shrinkage," Dec.].

They can now buy the chemical in small quantities—a 4.46-lb. package for \$7, or two or more for \$6 each—from the Crane Gun Stock Co., Waseca, Minn. One package dissolved in five quarts of water makes seven quarts of 30-percent solution. Crane will also supply the polyurethane varnish—a half-pint for \$2.50, or a full pint for \$4.

F. A. STRENGE, Madison, Wis.

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The month in science

Disintegrator ray. Taking their lead from Buck Rogers, the wizards at Carl Zeiss over in Germany have come up with an honest-to-gosh disintegrator. Only it turns out to be a high-class milling and welding machine instead of a handy weapon for blasting unruly Martians.

Zeiss's Electron-Beam Milling Machine is unlike anything any blue-chip machinist ever hovered over. It's big—five substantial cabinets speckled with knobs, meters, and lamps—but it works

only on small pieces. They go inside a vacuum at the bottom of a tank. The cutting tool is a needle-sharp beam of electrons shooting down the tank. The beam disintegrates whatever it hits, heating the target area so hot—11,000 degrees—that those atoms boil away (the rest of the workpiece stays cool, comparatively).

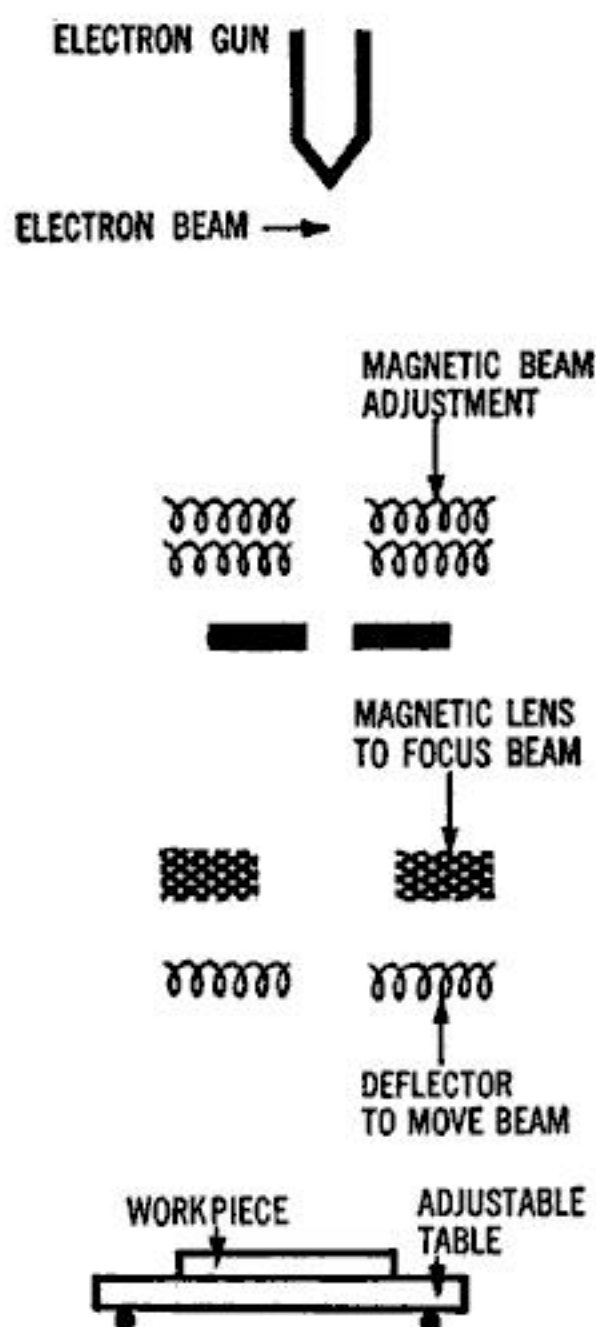
The tricks you can do with such a powerful and precise tool are fantastic: bore 100 holes in a straight line across the head of a pin, drill clean through a sapphire watch bearing in seconds, weld .060-inch-thick stainless-steel sheet into T shapes at the rate of seven feet a minute, cut accurate slots as small as .0008 inch in the hardest materials. The beam machine will come in very handy for such demanding jobs as welding cores for atomic furnaces, drilling the tiny nozzles in spinnerets that extrude fibers, and milling those small-as-a-speck-in-your-eye parts for modern electronics. It will operate on all kinds of exotic but essential materials—from columbium to zirconium—that defy ordinary cutting and welding techniques.

You can't control this electron cutter with a handwheel, miking as you go. Magnetic coils inside the tank guide the beam, in

precisely the same way deflection coils in a television picture tube control movement of its image-tracing beam. A magnetic-tape recording feeds signals to the deflection coils, providing the "program" for a complete job.

The electron-beam machine is the brainchild of a rather grim-faced Rhinelander, 39-year-old Karl Steigerwald. It will be manufactured in the U.S. by Hamilton-Standard, the airplane-propeller outfit.

The great helium shortage. For a while it looked as if deep-sea divers, welders, and highbrow physicists were going to run out of their oddest essential material, the strange gas helium. The supply to department stores was cut off temporarily—that's why the big beautiful balloons were missing from the Thanksgiving Day parades two years ago. But now the Bureau of Mines' huge



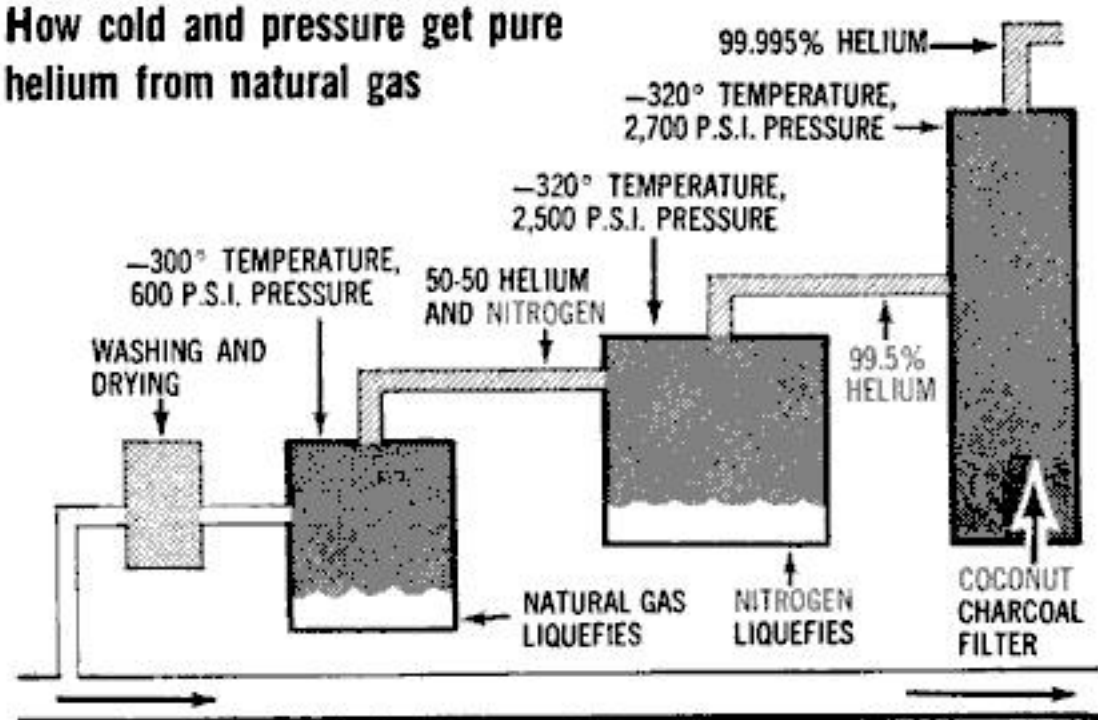
The month in science

new plant at Keyes, Okla., is pouring out the stuff, and 12 more refineries are planned.

The reason for the helium shortage was its sudden postwar popularity—for uses besides filling balloons and blimps. Demand multiplied five times in the past 10 years. Deep-sea divers breathe it

mixed with their oxygen supply (helps prevent the bends). Welders use it by the tankful—it forms a corrosion-blocking blanket over the weld area, essential for work on tricky metals. The most sensitive electronic amplifier ever invented, the maser, won't work unless it sits in an atom-freezing bath of liquid helium. Manufacturers of tubing pump helium through the prod-

How cold and pressure get pure helium from natural gas



uct to spot leaks—it's the leakiest stuff known except hydrogen, revealing in minutes a hole too small to let out a quart of air in 2,000 years. The National Archives preserves the originals of the U.S. Constitution, Declaration of Independence, and Bill of Rights inside glass cases filled with helium (this gas won't deteriorate anything).

By any yardstick, helium is an oddball among the elements. Even its discovery was extraordinary—a self-taught astrophysicist, J. Norman Lockyer, first spotted it on the sun, and not until 23 years later was a trace found on the earth. Its strange properties are what make it so valuable.

- ▶ It is an absolutely inert gas. It can't burn, or explode, or react with any kind of chemical, or corrode anything.
- ▶ It is much lighter than air, just fine for lifting balloons. (Hydrogen is lighter still, but very explosive.)
- ▶ It changes to liquid at a lower temperature than any other substance, just a few degrees above absolute zero. And then it acts more strangely yet. One form of the liquid runs uphill.

The U.S. Government has a total monopoly on helium production (outside Russia, anyway). Natural (cooking) gas from wells in Texas contains a tiny fraction (about two percent) of helium. The Government taps into commercial pipelines, wrings out the helium (by chilling the gas to liquefy everything except helium), then sends the cooking gas back on its way to your kitchen range. The pure helium is shipped from the Southwest to the rest of the country by tank car and tank truck. It's not cheap. One tank car (250,000 cubic feet) of helium sells for \$4,750 plus freight, wholesale, but the Government, which is its own best customer for this queer commodity, gives itself a discount.

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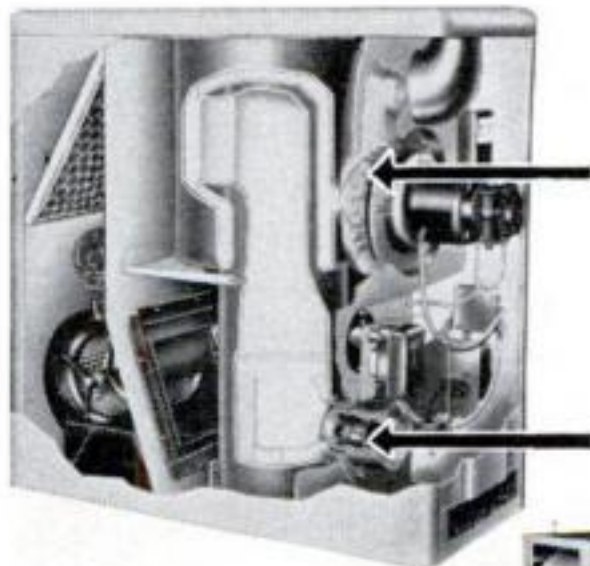
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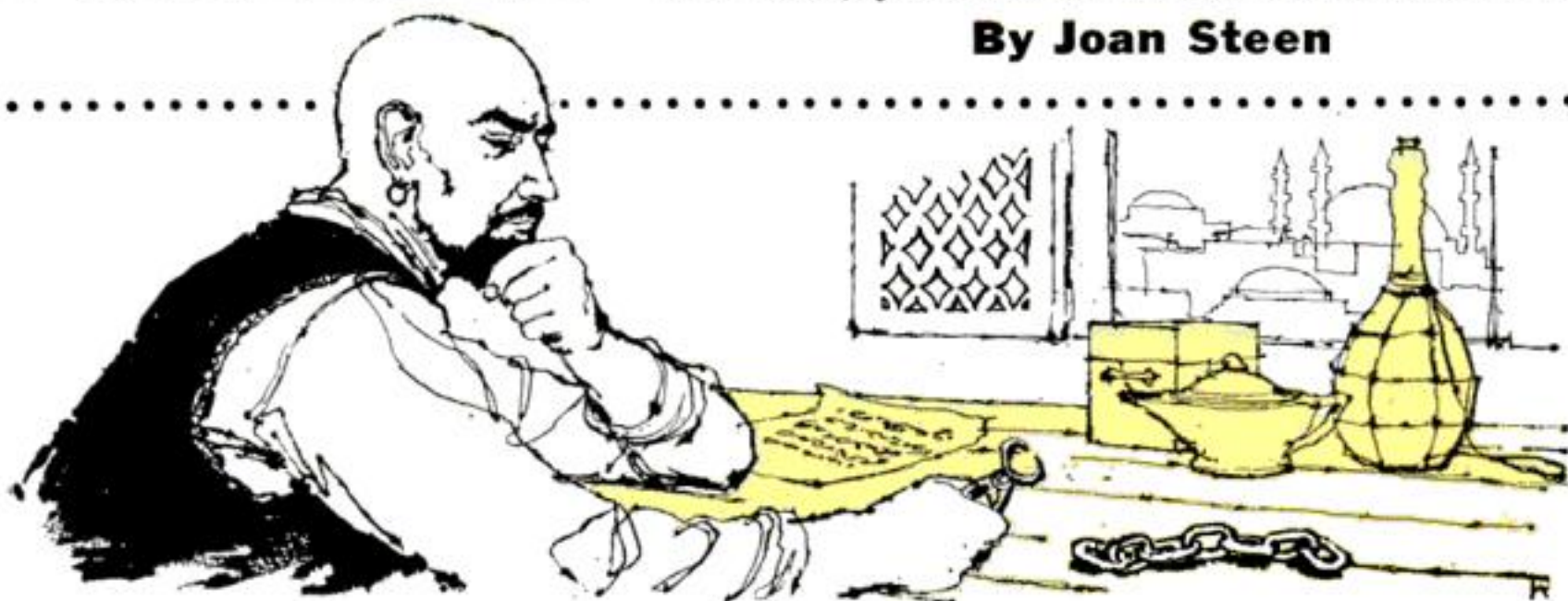
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By Joan Steen



The case of the seven-link chain

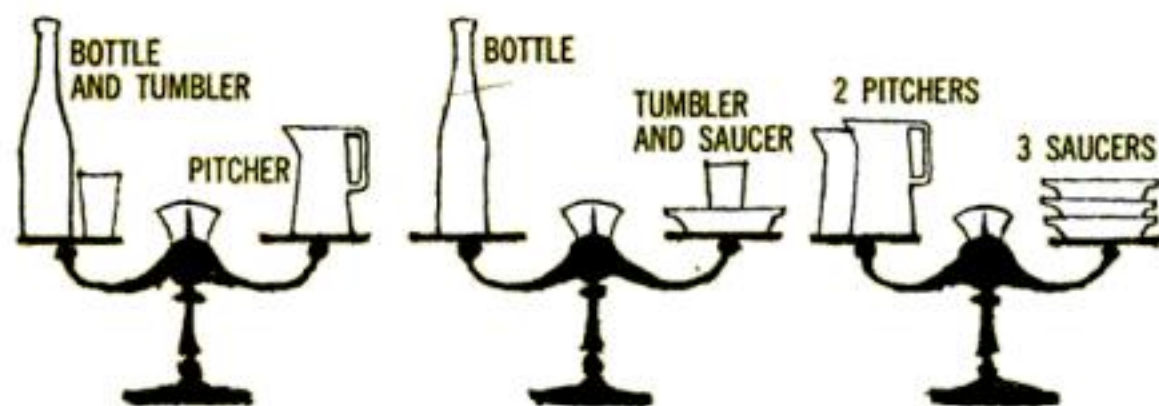
HERE'S a brain teaser that might have come straight from the Arabian Nights. I like it because the solution is so ingenious.

A traveler in the East arrived at an inn robbed of all his possessions except a gold chain. The chain, not joined at the ends, had seven links. The innkeeper offered the traveler lodging for a payment of one gold link each day, as long as the chain lasted—but he would neither accept payment in advance nor allow any payment to fall in arrears.

The traveler at first was unhappy at the thought of mutilating his beautiful chain by breaking off a new link every day, but soon devised a way to make this unnecessary.

(Fortunately, the thieves were caught and the traveler's money was returned at the end of a week, just as the links ran out.)

Your problem is to find the minimum number of breaks the traveler had to make in the chain and still satisfy the demands of the innkeeper.



YOU can solve this by looking at it. But there's a mathematical way out, too.

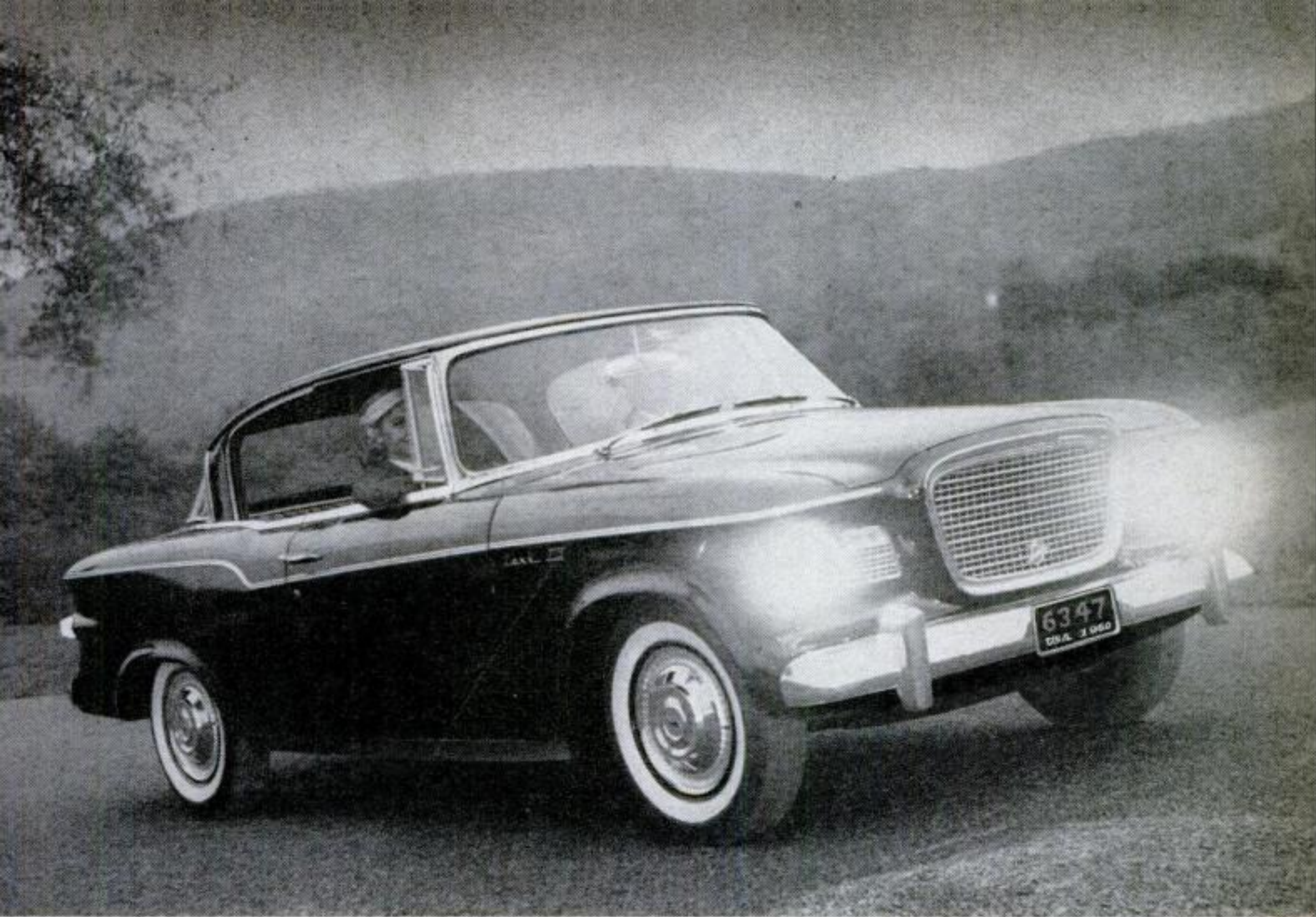
Each weighing is balanced. Express the bottle's weight in terms of the tumblers.



LOGICAL puzzles—more than most—sound utterly impossible when you first read them. The trick is to steer your way through the facts one at a time, remembering that a fact often tells you more about what's *not* possible than what is.

Clark, Daw, and Fuller make their livings as carpenter, painter, and plumber, though not necessarily in that order.

1) The painter recently tried to get the



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PS Puzzlers

carpenter to work for him but was told that the carpenter was out doing some work for the plumber.

2) The plumber makes more money than the painter.

3) Daw makes more money than Clark.

4) Fuller never heard of Daw.

Can you tell who's who?

CARE to match wits with a Greek thinker who lived 2,500 year ago?

Anaximenes said that all matter could be reduced to one substance: the "mist." When rarefied, the mist was warm. First it formed air; eventually it became fire. When condensed, the mist cooled, first becoming water, then earth. Anaximenes invited his listeners to test his theory.

"Open your mouth wide and blow on your palm," he instructed. "The rarefied vapor comes out warm. Now purse your lips and blow out a thin stream. See how cold it is? That's condensed vapor."

Can you explain why—non—"mistily."



A MECHANICALLY minded fellow thought of this one. It's the kind of thing that could happen to anyone.

Lester decided to replace all the noisy snap switches in his house with silent mercury ones. He'd never installed any of these before, but he found they had the same two terminal screws as the ordi-

nary switches with which he was familiar.

Having turned off the house current, he was mildly annoyed to find he had mislaid his glasses. But the work involved no eyestrain, so he replaced all 10 switches rather than stop to hunt for the specs.

When the current was turned on, four switches worked, six did not. Why?

Puzzle of the month



LUCKILY someone told me the answer to this one at the same time as the puzzle. Otherwise—like the wife of one PS editor—I might still be working on it:

The census taker, placing one weary foot after another, climbed the steps and rang the bell. "How many people live here?" he asked the person who answered the door.

"Three," was the prompt answer.

"And their ages?"

The reply startled him: "The product of our ages is 225, while the sum is the same as the house number."

The census taker looked up to check the number he had already noted on his tally sheet, "Hmm," he said, "I need to know one more thing: Are you the eldest?"

"Why, yes," the person said. And the census taker, cheered at the novel answers, smiled as he wrote down their ages and walked away.



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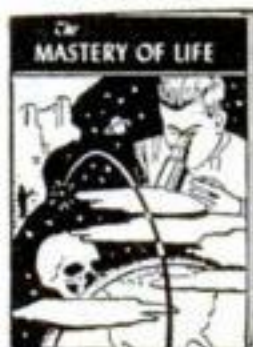


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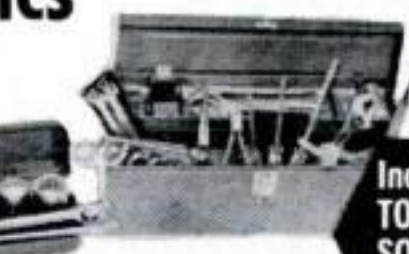
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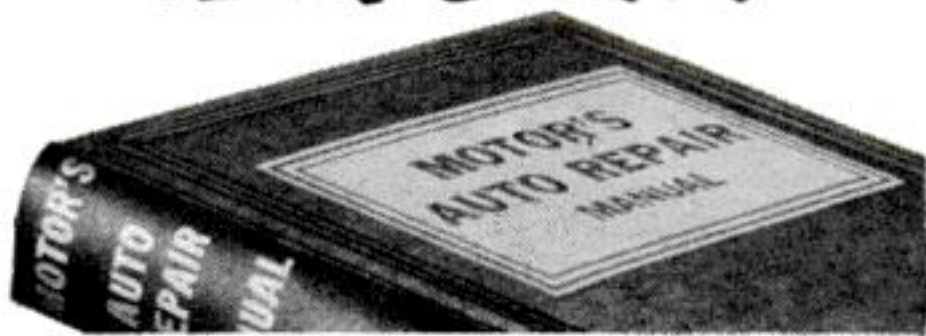
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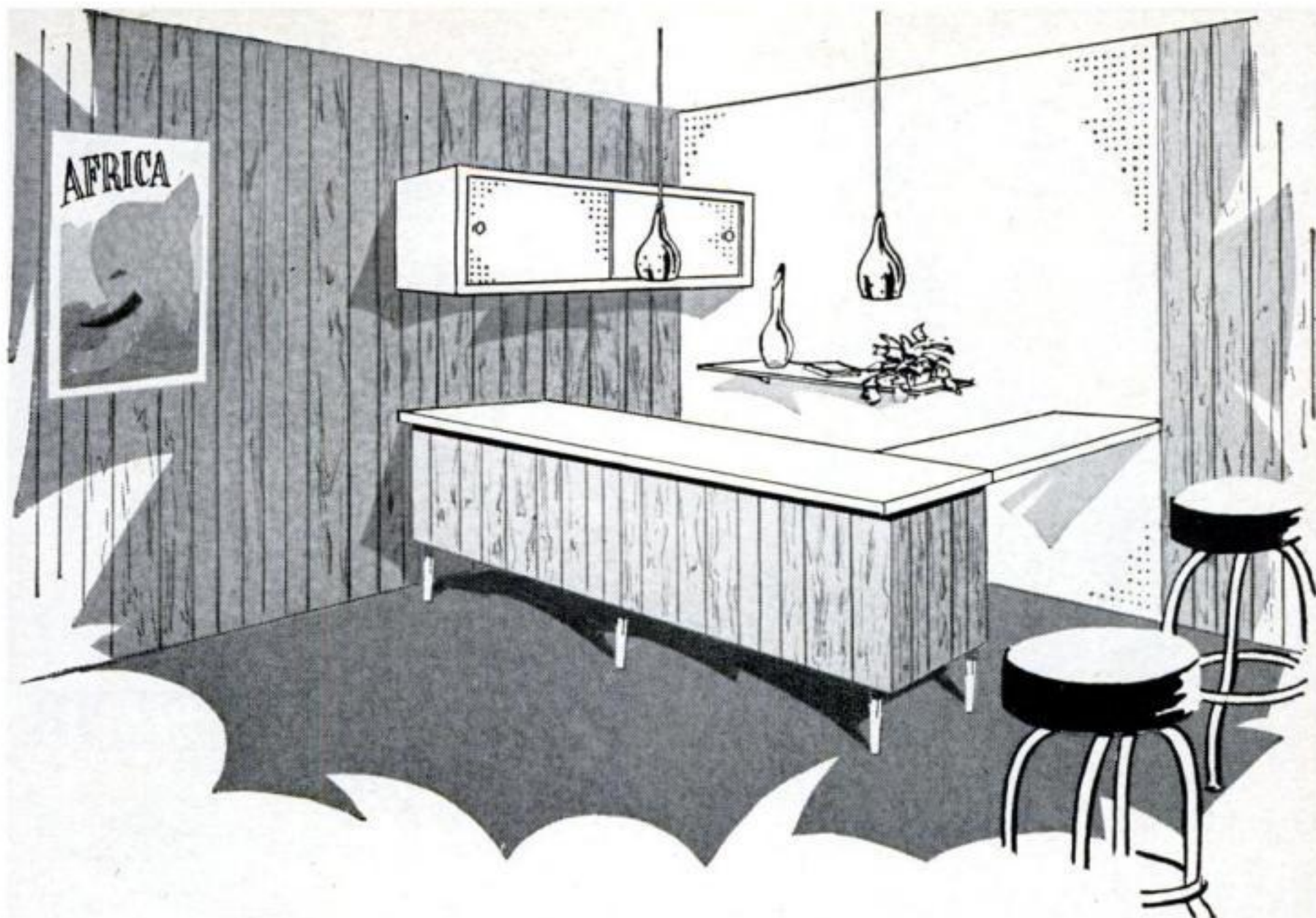
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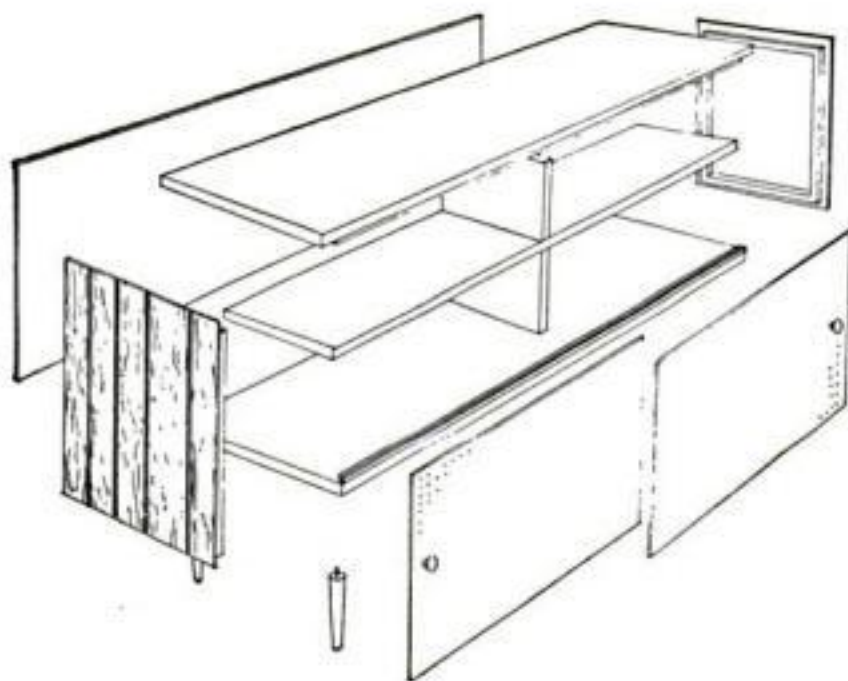
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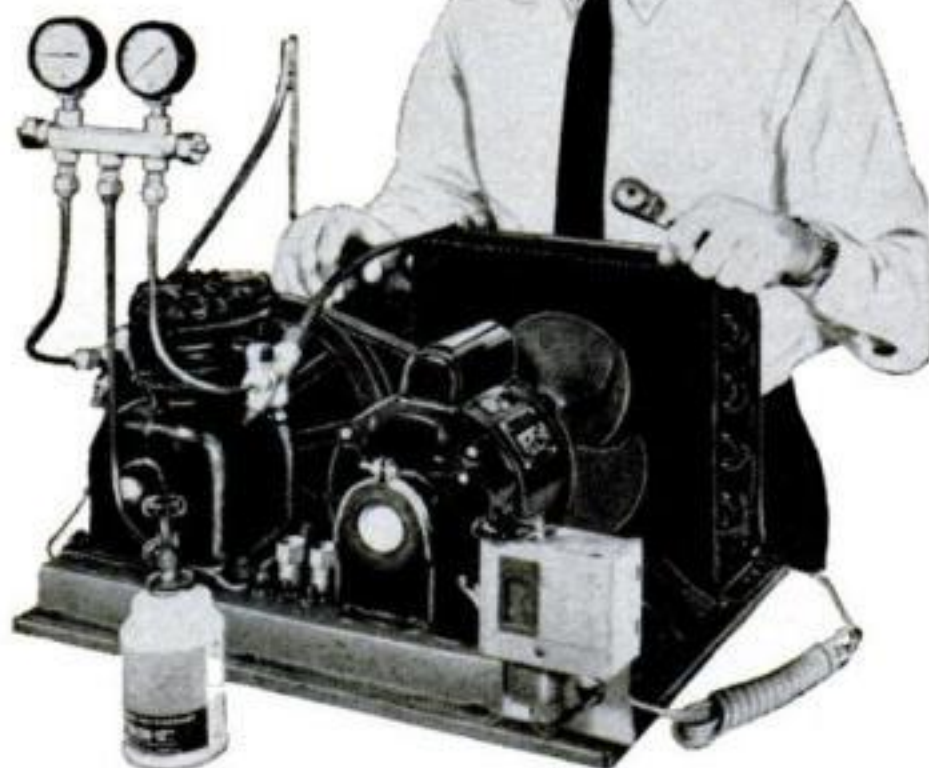
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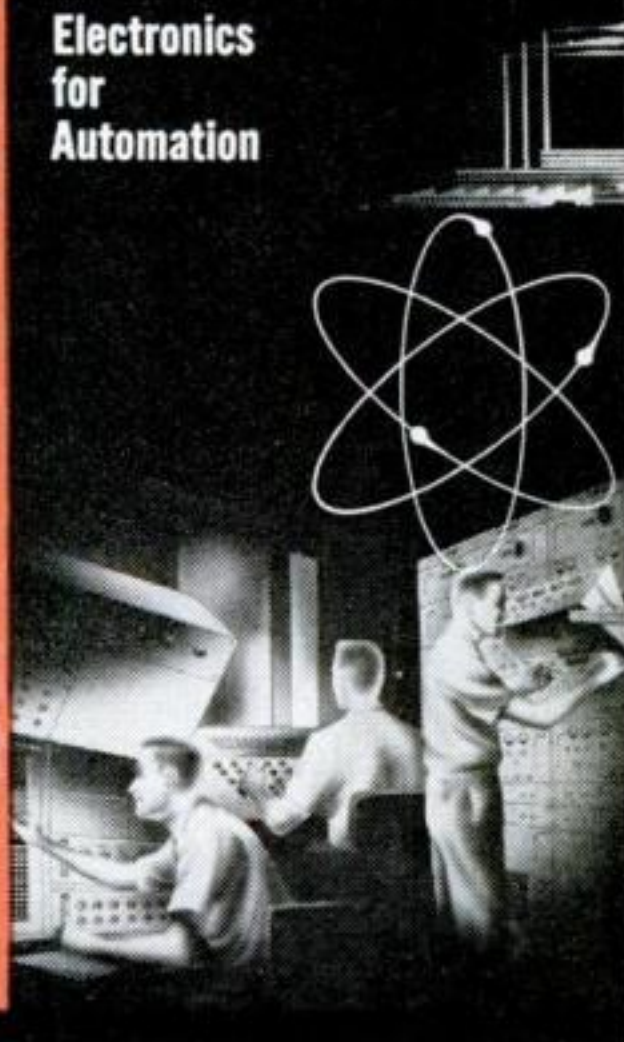
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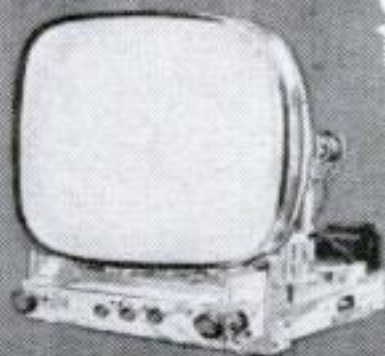
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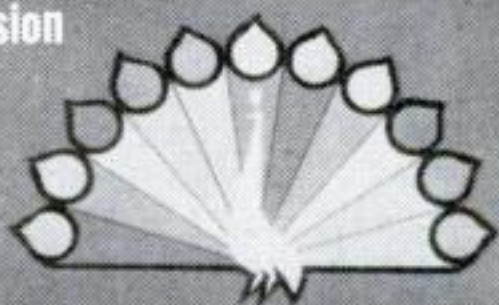
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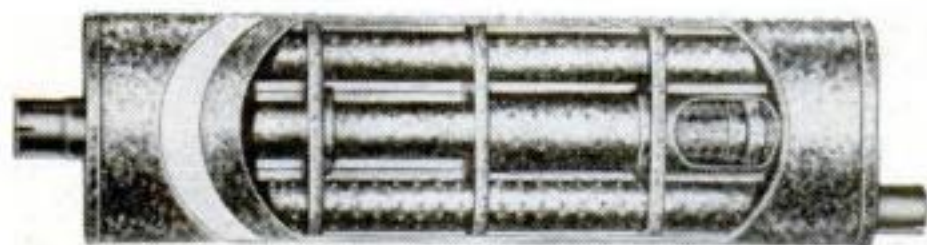
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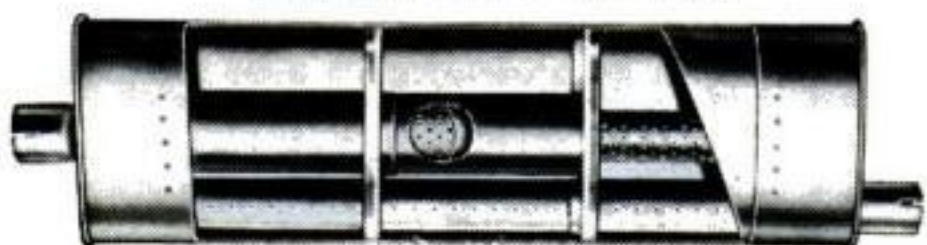
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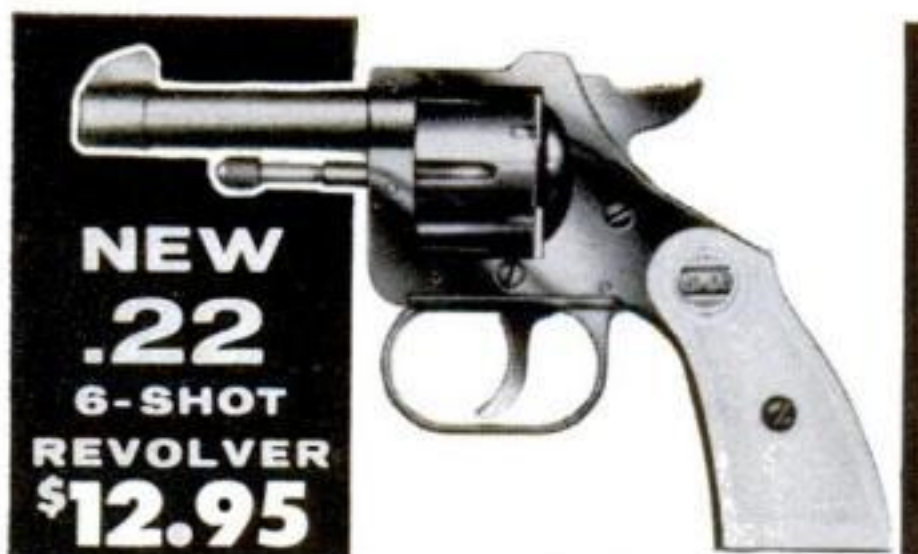
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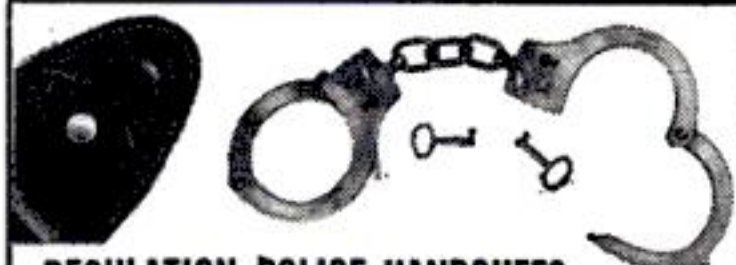


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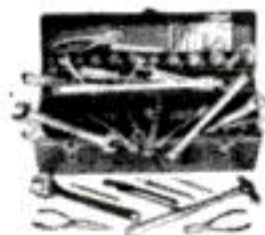
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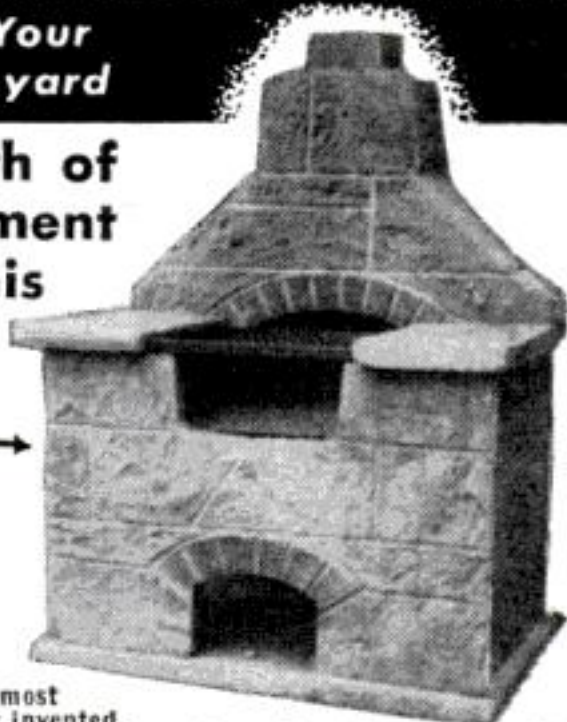
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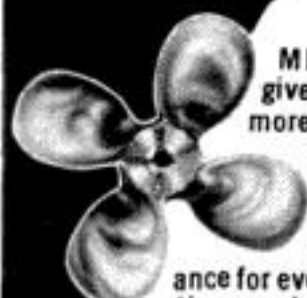
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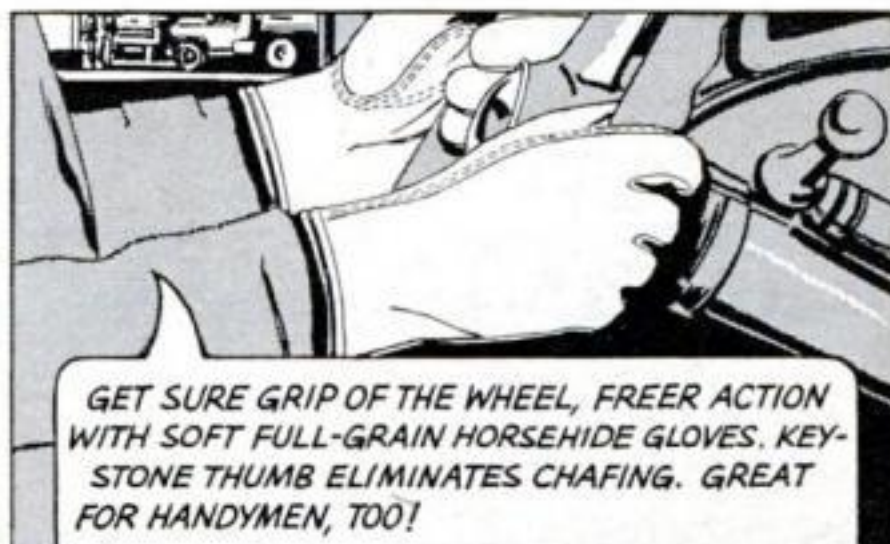
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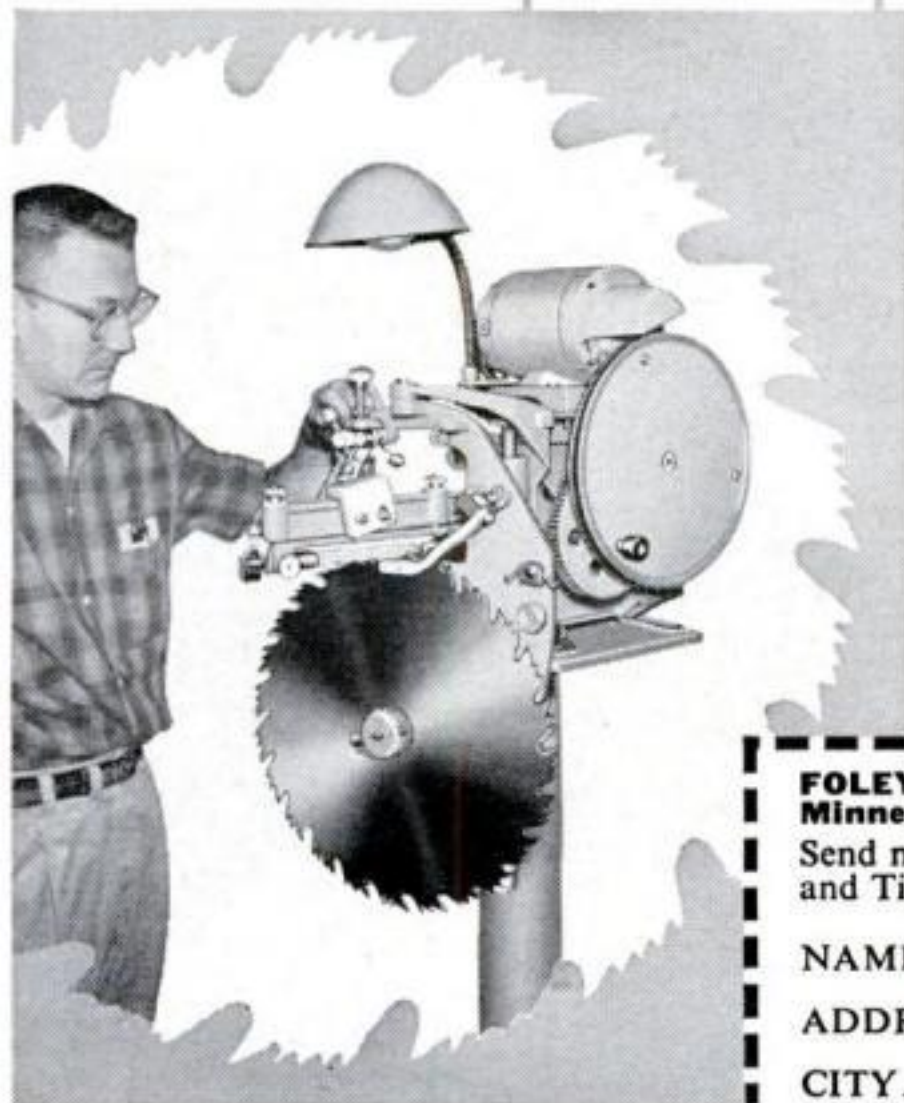
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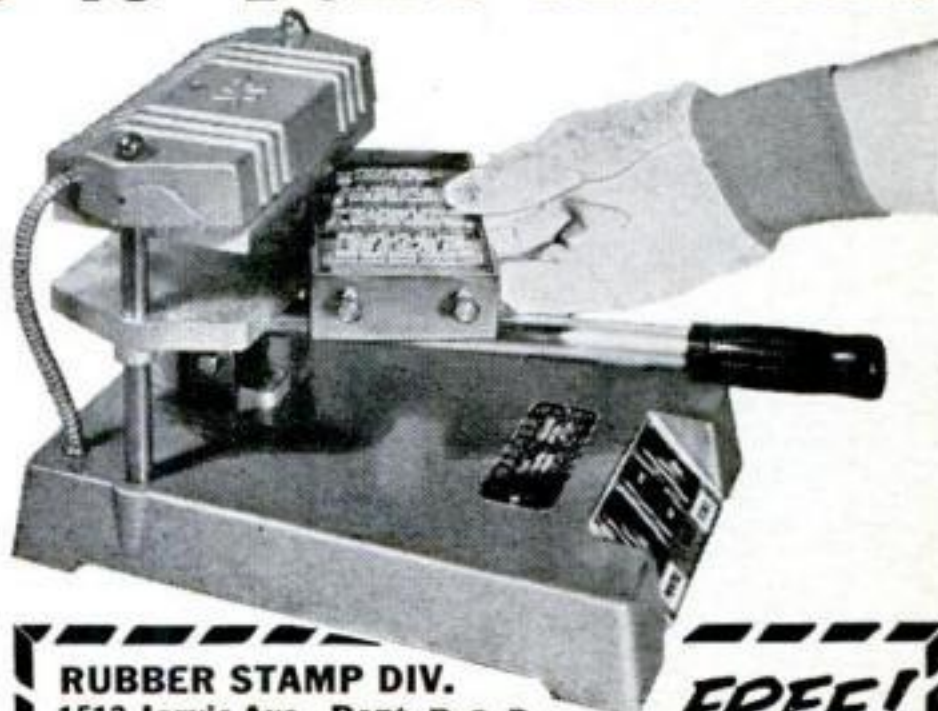
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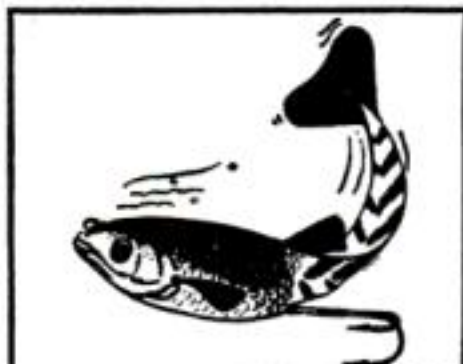
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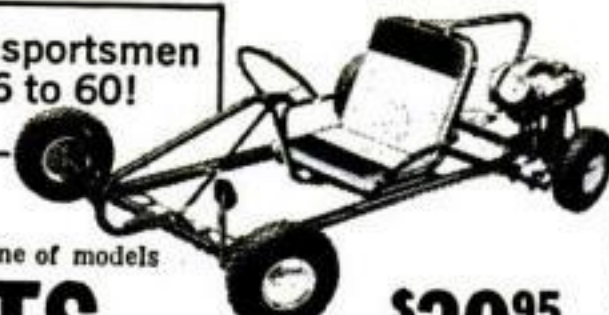
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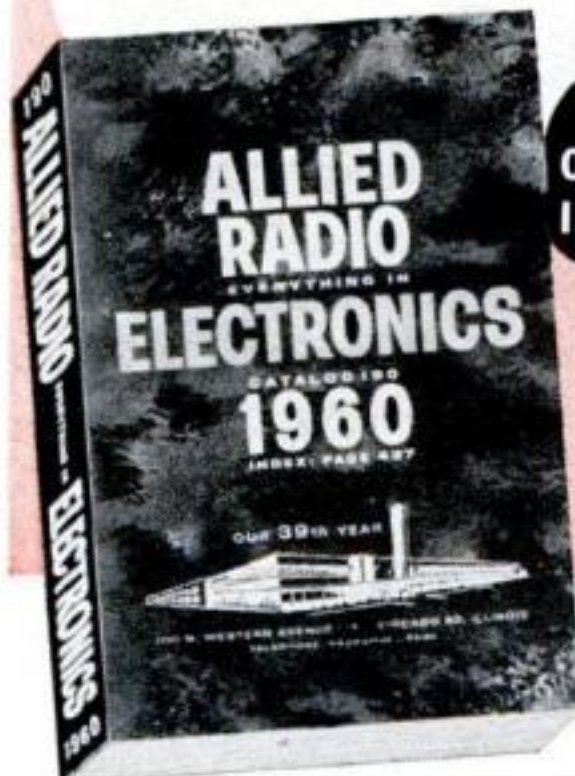
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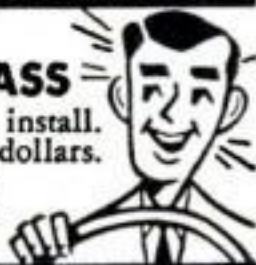
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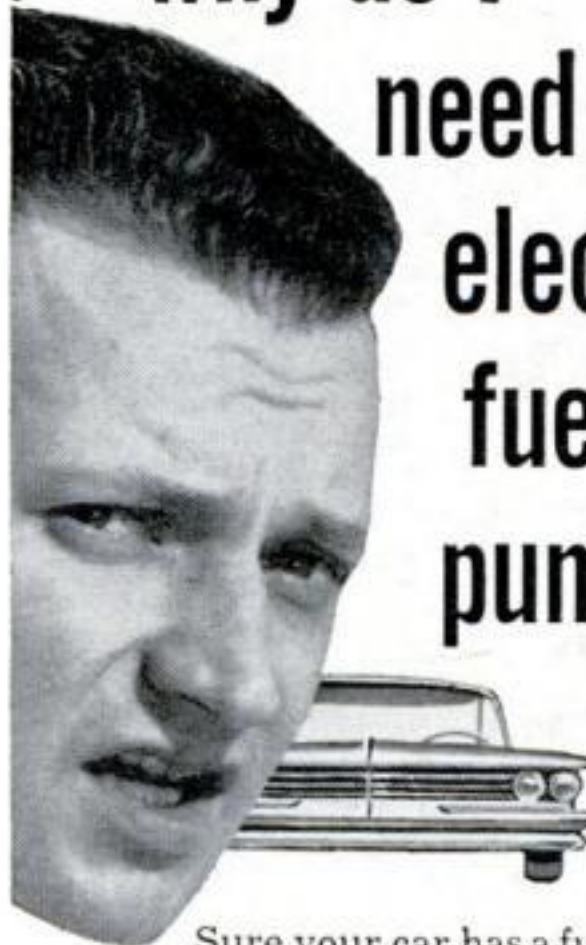
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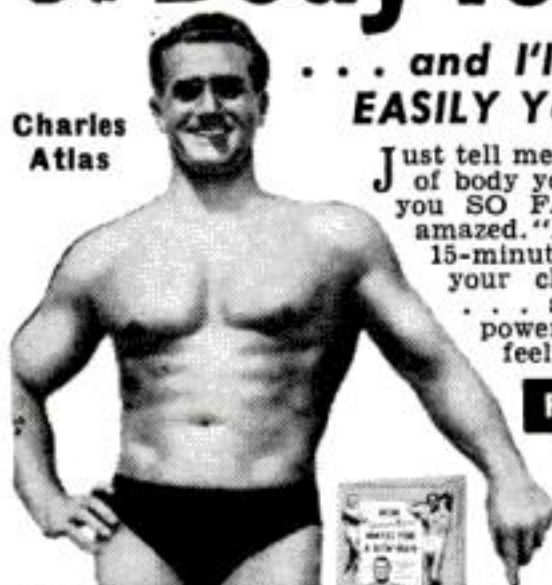
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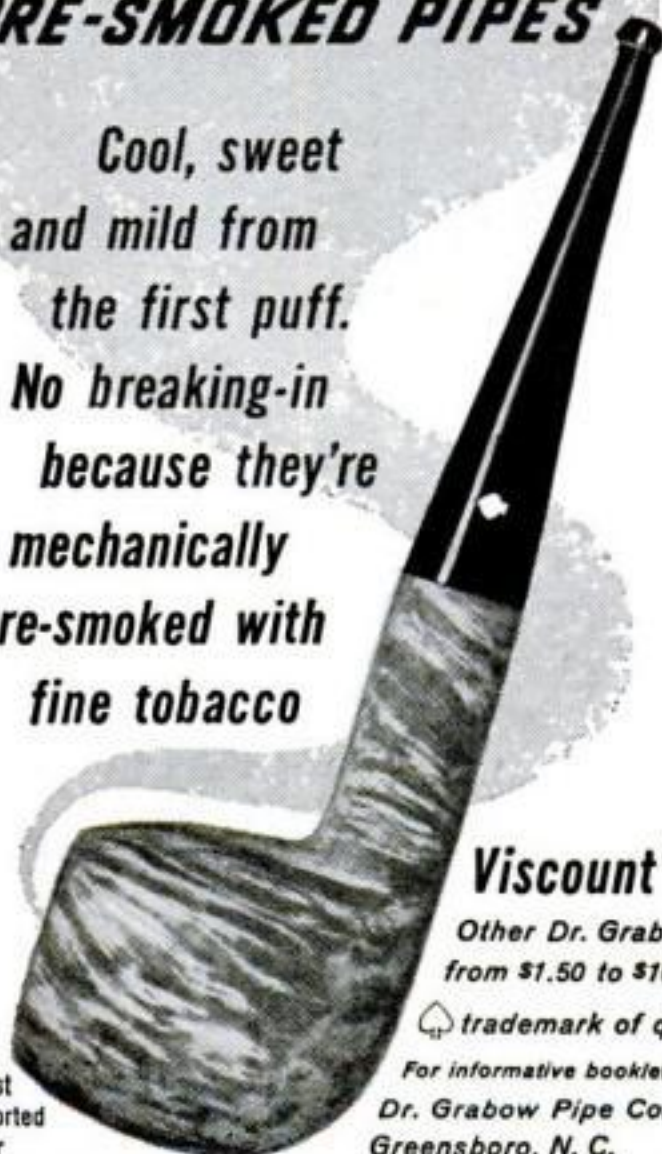
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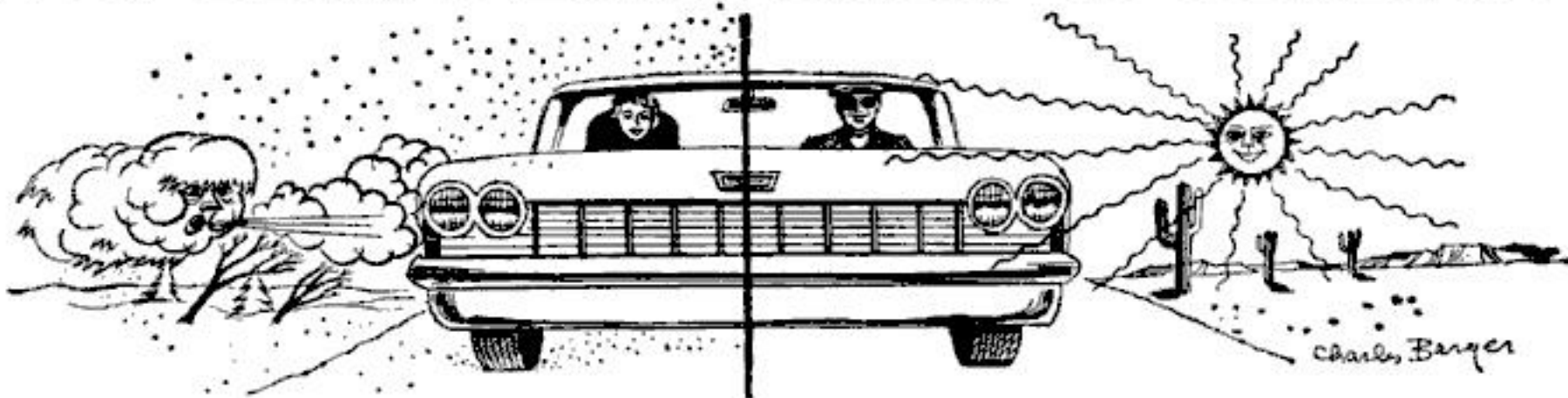
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that their new brew is not just an anti-freeze. They claim it has superior heat-transfer qualities and minimizes rust and corrosion, especially where there is much aluminum in the cooling system.

Dowgard is a blend of glycols, inhibitors, and specially treated water—pure as water distilled four times—designed to protect an engine from 40 degrees below to 240 degrees above zero. Filling a 17-quart radiator costs \$9.60.

Three carbs for Falcon. Two carburetors are added in the hop-up kit for Ford's compact-car engine. They're mounted fore and aft of the single stock carburetor by means of an aluminum casting that lies on top of, and is spliced to, the regular cast-iron manifold. Linkage is progressive, so the end carburetors open only when needed for quick acceleration or high speed.

The hop-up package also includes a hot

camshaft, special pistons that raise compression, and a special low-back-pressure exhaust system.

Insiders report that, since Ford quietly catalogued the special parts and reported an official rating of 128 hp., engineers have further developed the power-pack engine. They reportedly are now turning it as high as 7,000 r.p.m. in tests and are getting close to one hp. for each of its 144 cu. in.

New Rambler American engine.

It's long been expected that American Motors would eventually offer its overhead-valve, 125-hp. six in Americans as well as in bigger Ramblers. That the move came when it did seems to have been triggered by the rash of hotter engine options for the Big Three compacts.

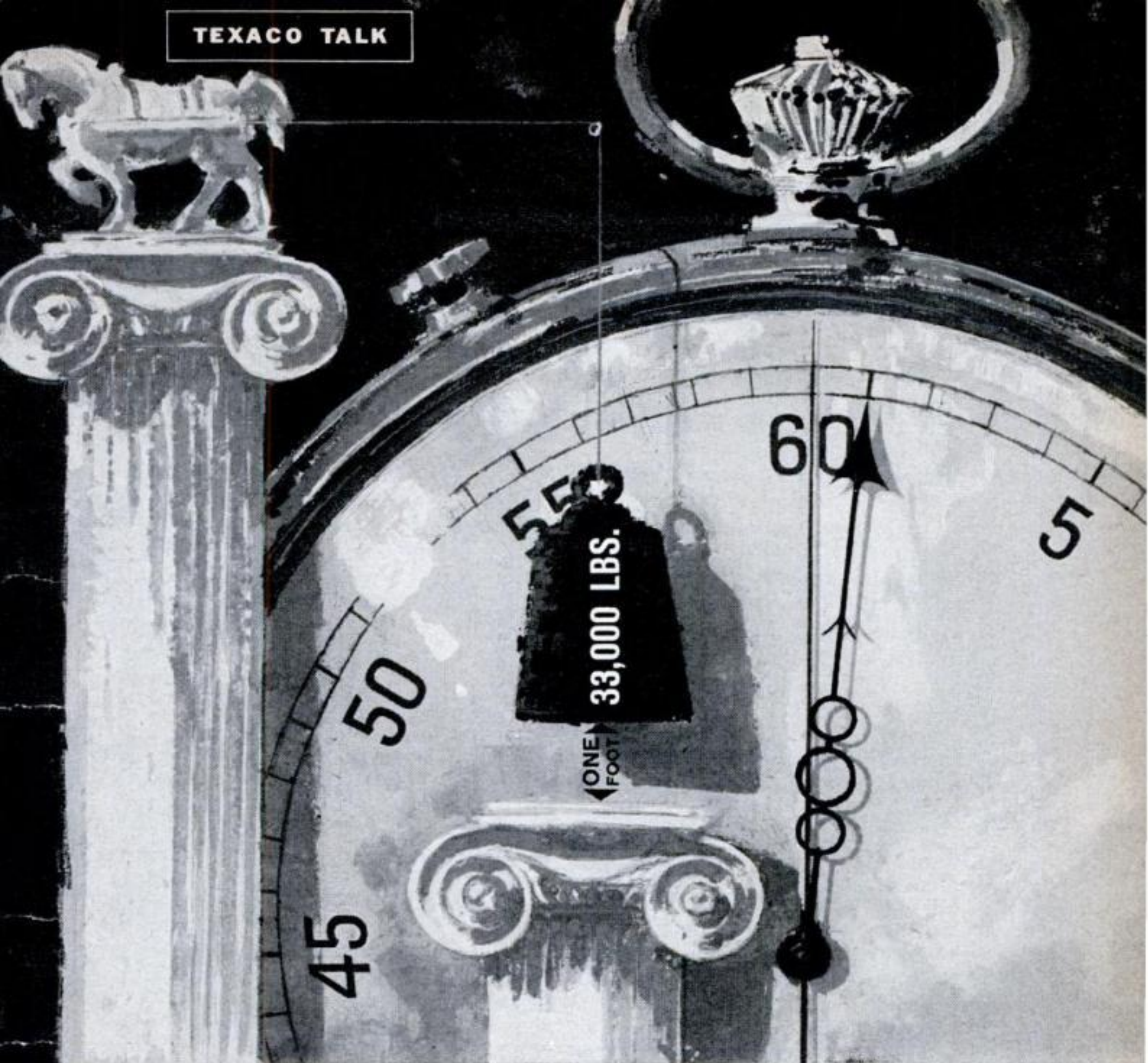
The overhead-valve six has the same

displacement, 195.6 cu. in., as the American's L-head six. The overhead six, in fact, is basically the same engine ingeniously converted, so there are few problems in installing it in the American.

The 90-hp. L-head will still be used in Deluxe and Super models. The overhead six goes into Americans in the new Custom series.

Gas turbines still need work. Before they can qualify for passenger-car

use, turbine engines will have to show much better fuel economy at low speeds,



What horsepower really means

James Watt, the inventor of the steam engine, determined that a husky horse could lift a weight of 33,000 pounds one foot in one minute. He called this horsepower.

Automobile manufacturers later adopted what they call *brake* horsepower—so named because they used a brake on the flywheel of the engine to measure horsepower. The method of measuring brake horsepower has undergone changes over the years, but the term is the one in everyday use.

Brake horsepower simply means the developed power that's actually delivered at

the engine's flywheel and therefore available to drive the car's wheels. The average American compact car engine has about 90 "horses," while the most powerful American car engine has about 350.

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DETROIT REPORT continued

according to Darl F. Caris, who heads the General Motors Power Development

section. He says gas turbines still can't compete with piston engines for cars.



Piston engines on the way out?

Probably—for cars aiming at John Cobb's 394-m.p.h. world land-speed record, anyhow. Jet engines will be used in most future cars challenging the 13-year-old mark.

A Los Angeles physician, Dr. Nathan Ostich, will try for the record next summer. His car will be powered by a 6950 GE turbojet like the ones used in B-36 bombers. Two well-known California hot-rodders, Mickey Thompson and Ak Miller, plan jet-powered record cars. Thompson made a gallant but futile try last

summer in a car with four Pontiac V-8s.

Donald Campbell, current holder of the world water-speed record and son of the one-time land-speed record holder, Sir Malcolm Campbell, is currently building a jet-engined car in England. He is expected to try for the record next summer.

Only piston-engined car reported being prepared for a record attempt this year is owned by Athol Graham, a Salt Lake City mechanic. He turned 308 m.p.h. with ease last fall at Bonneville, using less than 75 percent of the power of his Allison V-12 engine.

Air-oil suspensions. With air suspensions having proved an expensive fizzle, several companies—GM is one—have switched their attention to air-oil hydraulic-suspension systems. Now used in

Citroen DS-19 and ID-19 models, which are noted for comfortable riding qualities, air-oil suspensions would be especially attractive should central hydraulic systems be adopted.

Buick's aluminum engine? First batch of tooling needed to produce aluminum V-8 engine blocks reportedly will be delivered to Buick about Feb. 1, 1961. This indicates that Buick will use aluminum engines in its 1962 models.

It's been expected that Buick's com-

pact car, due this fall during the 1961 model-introduction season, would have a small-displacement aluminum engine of about 215 cubic inches.

It looks now as though the car will appear, initially at least, with a conventional cast-iron block.

Little brother for Falcon. Ford engineers are working on a really small car with a wheelbase of 96 inches and a four-cylinder engine—possibly a V-4—displac-

ing about 90 cubic inches. Target weight of the automobile is 1,650 lb. It is possible that the car is being developed primarily for an overseas market.

Compact Dodge coming. Name of the smaller, Valiant-sized Dodge expected next fall has been variously reported as Lancer, Warrior, and Vanguard. Van-

guard seems to have the inside track. The car will be a close cousin of the Valiant mechanically with some changes in sheet metal to give it its own personality.

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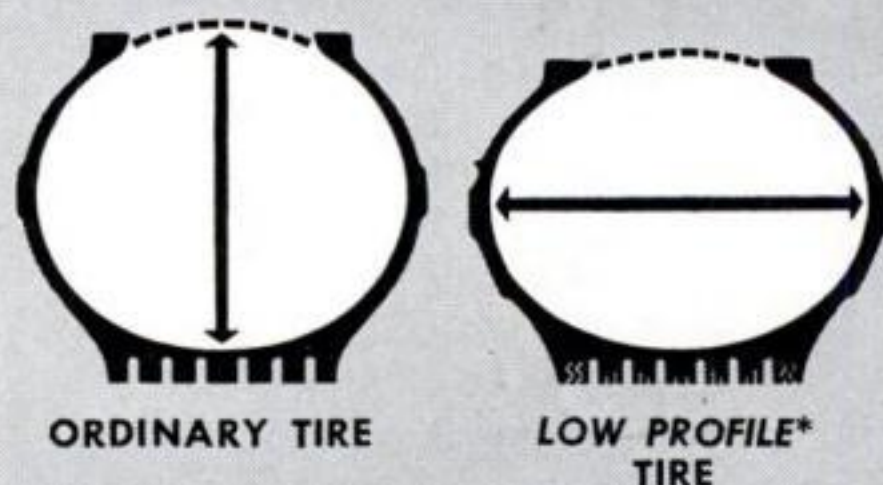
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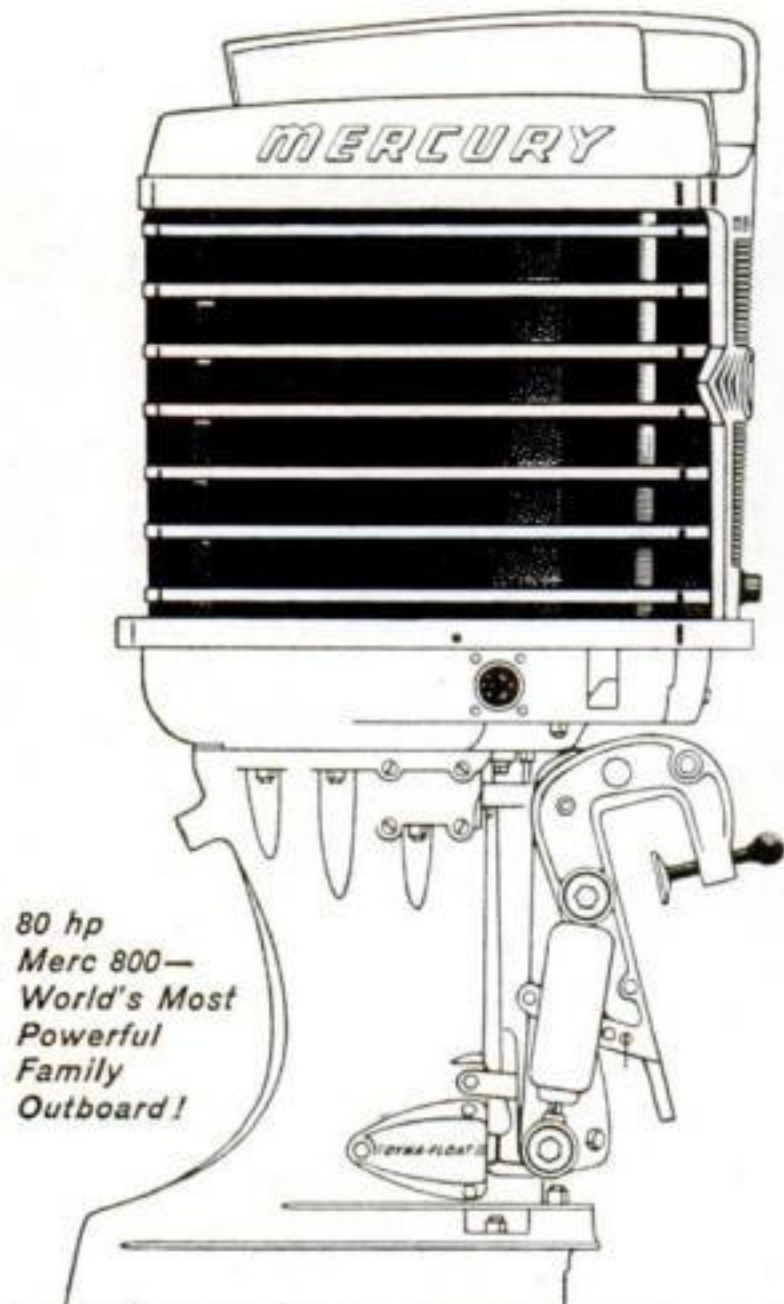
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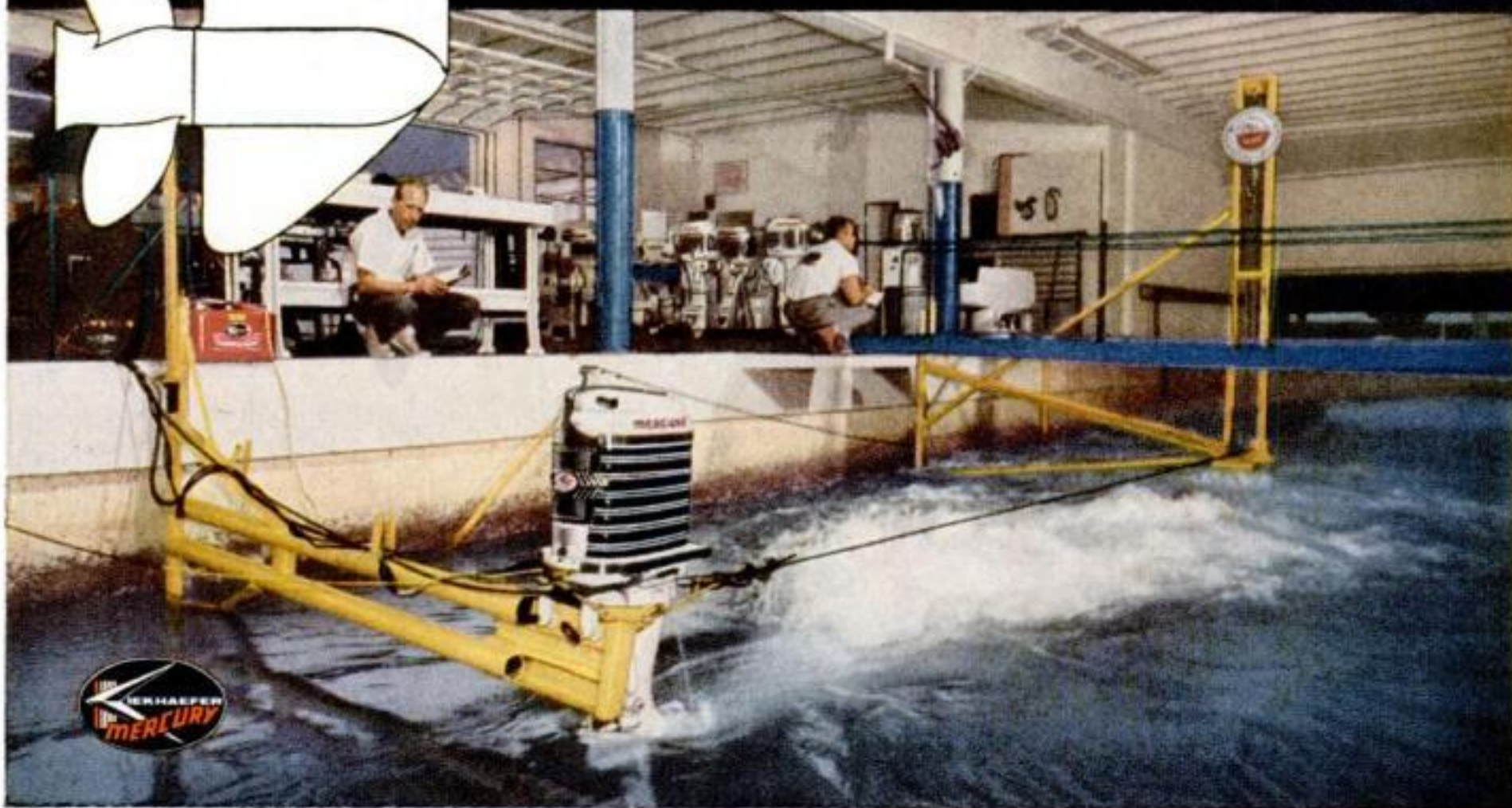
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Outboard!

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...FUEL ECONOMY...STYLING...FEATURES...SAFETY**



Here Come Turnpike Trains



Huge tandem trailer trucks are appearing on our fast highways. Climb aboard this one for a 500-mile run

By E. D. Fales Jr.

NO. 7003 is estimating Boston at six p. m.," said the Western Express agent. "She'll lay here four hours. At 10, she starts back. You could meet her at the diner in Watertown at 10:30 p. m."

I was eager to ride this road locomotive. No. 7003, twice as powerful as most trucks on U. S. roads today, is a West

Hand signals by day (and flashlight signals at night) guide switching and coupling

Coast diesel tractor built for the new two-trailer truck trains now working Eastern turnpikes. These rigs, called "doubles," have been running in a few states for years. But the job I was to ride would be half again as long—a real turnpike train.

These may be the freighters of the future on the pikes. Obviously costs go down if one engine and crew can haul two trailers. The New York Thruway and Massachusetts Turnpike recently authorized them, after long, careful safety tests. The Kansas pike is now conducting test runs, and Indiana and Ohio will soon follow suit.

Storm warnings. At 10:15 p. m. I was in Nugent's diner in Watertown, Mass., alternately drinking coffee and mopping steam off the window. It was a warm night, but the weather felt suspicious. Then the radio warned: a storm building up near the Lakes—which was where we were going.

No. 7003 came throbbing in at 10:30 on the nose: a great glistening yellow cab crowned with five golden lights. She didn't sound like the usual road horse. She was a Kenworth, built in Seattle. Her clean, square lines and eight "twin-screw" driving wheels spelled extraordinary power. Her tall silver stack pulsed with thrumming sounds. I thought: "They're beginning to *sound* like locomotives."

She had left Ripley, N. Y., on the Pennsylvania border at 2:30 a.m., heading east. Now the trip back was beginning. Behind her was a long, sleek aluminum box with a specially reinforced steel frame for road-train work, for the lead trailer in a double rig must be extra strong.

No. 7003's door opened and a huge man spidered down the side.

"I'm Clark Stephenson," he said. "Leroy Balliet will drive to the turnpike. Then he sleeps and I take the next 300 miles."

I swung up into the large wheelhouse, with windshields like picture windows. Stephenson rode for a while in an escort



1 "SLOW AHEAD," signals Steve, as No. 7003, with one trailer already on, rolls across yard to pick up dolly and a second trailer.



4 COUPLING LEAD VAN TO DOLLY is next step after Leroy has turned first half of train around. In mirror he sees Steve's signals.

car that followed us so that, at times, I could watch No. 7003's performance from the road.

Balliet's seat—adjustable and "as comfortable as an armchair"—was far over against the other window. Between us was a large cloth-covered table—really the top of the box over the 335-hp. Cummins diesel. Too far to shake hands.

"Hi," said Leroy cheerfully. "You'll like this baby. She's new but she's a veteran already—70,000 miles in six months. We shuttle back and forth three times a week between Boston and Ripley—that's 1,000 miles each round trip.

"We can't run double on state roads—only on the New York Thruway and Massachusetts pike—so we'll pick up our kite at the first gate."

"Our kite?"

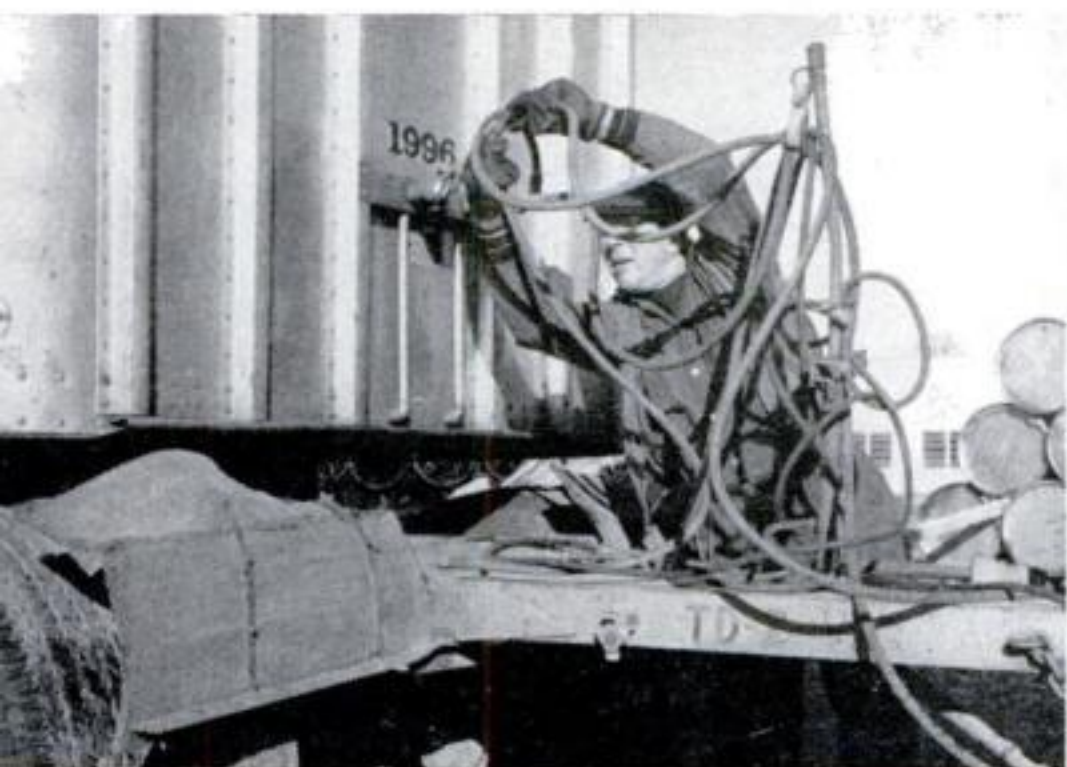
"The second trailer."



2 **AUTOMATIC COUPLER** holds dolly in place as No. 7003, driven by Leroy, pushes it toward "kite" trailer waiting near freight shed.



3 **STILL PULLING LEAD UNIT**, No. 7003 shoves eight-wheel dolly into position from which it will later be bucked under second trailer.



5 **PUSHED INTO PLACE** under its trailer, dolly is linked to lead trailer by steel tongue. Above, Steve couples air hose and light wires.



6 **RETRACTABLE DOLLY** on which van had been resting in yard is cranked down. After light and air-brake test, train will be ready.

He started in sixth gear, worked up to twelfth, and we swung rapidly across a town square with trolley wires inches above our heads. Leroy touched the horn. Twin trumpets on our roof split the night.

Picking up the kite. At 11:10 we rolled into the new assembly yard, especially built for the doubles, at the Massachusetts pike. Guided by signals from Clark Stephenson's flash, we performed an intricate switching operation to pick up the kite.

Steve took over the wheel. "Light load tonight," he said. "We have carried 127,000 pounds. Tonight our lead—the first trailer—has 19,000 pounds of freight. Shoes, clothes, castings, for Cleveland. Kite's empty. We're deadheading it to Chicopee, Mass. There we'll cut it off and pick up a new one: 21,000 pounds of freight for Detroit."

After a brake test, Leroy swung his flash and got in the escort car. He'd sleep later.

Steve started in creeper first gear. We rolled up to the tollgate. "You have to make an extra swing with these rigs to line up the last trailer for the gate," he said. Our train was an impressive 90 feet long (some go to 98). I looked in the big side mirror. Following docilely along, like two huge tame bears with friendly lights on their sides, were our trailers.

What impressed me most was the thought that we were now rolling on 34 wheels: 16 on the kite, eight on the lead, and 10 on the tractor.

The tollgate sign said: ROAD DRY. Steve grinned happily. I didn't have the heart to tell him what the radio had said.

A stop for fuel. Chicopee is a WX (Western Express) terminal. Here by

Flagman with lantern walks ahead when train crosses street



Leaving turnpike at Chicopee, Mass., No. 7003 halts, throbbing, at Montgomery St. crossing

special dispensation of the local authorities, we could leave the pike, roll across Montgomery St., and enter our terminal. But, by law, we had to have a "flag."

We left the pike and halted, chuffing, for the street crossing. Our air pumps throbbed softly. Then a flagman appeared in the street. It was Leroy. He checked the street, swung a "come ahead" light, and we moved across into the floodlighted terminal.

No. 7003 moved slowly up to the lighted pumps for refueling. Steve flipped a lever on the dash. "That's our parking brake," he said. "Locks everything up."

While Steve climbed down and brimmed the two 80-gallon tanks, Leroy opened a small door between our four front headlights and began pulling out a wire snake.

"That's our oil stick," he said. He pulled out eight feet of cable, wiped the

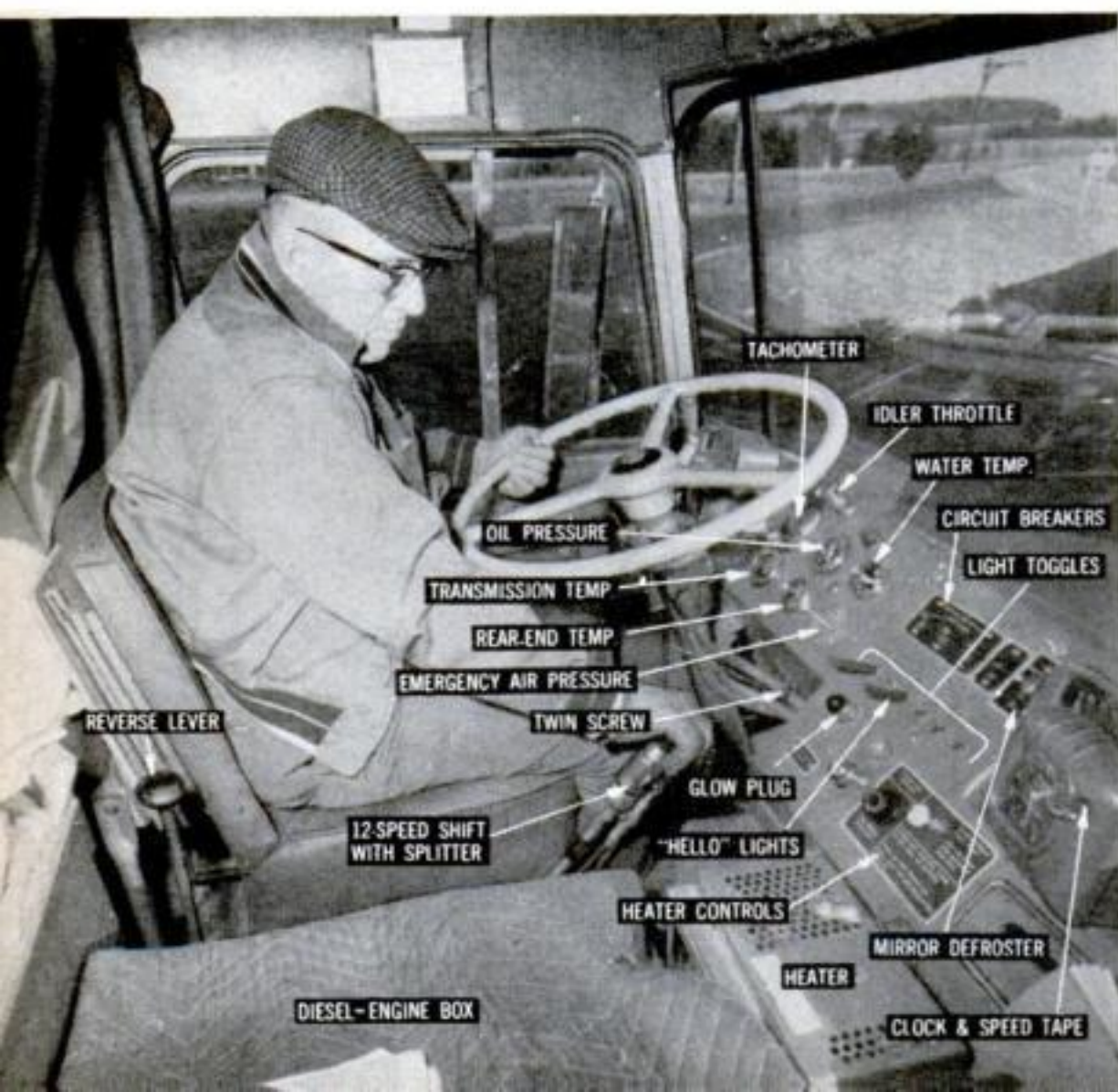
end, and jabbed it back. No. 7003 took two quarts.

The trailer for Detroit lay in a corner of the yard, crouching on its front dollies. Guided by Leroy's flash, Steve 1) dropped off the empty kite; 2) pulled the wheel-truck (also called a dolly) out from under it and transferred it to the Detroit trailer; then 3) backed his lead trailer against the kite. We heard the automatic coupler jaws lock viciously. Leroy hooked up two safety chains, coupled two air-hose connections (one for each side) and the electric cable. Then he threw a slack-takeup lever, signaled for a brake (and light) test, and we were off.

Steve worked up from first to sixth in low range. Then, at about 20 m.p.h., he flipped the lever on the ratio splitter. He went on up the ladder through high range, shifting every 30 seconds until he'd climbed into twelfth. The new kite was bigger than the old one. I watched it in the mirror. We could *feel* the 40,000 pounds of freight behind our necks now.

Wind and rain. We hit the first mountain grade in the Berkshires and Steve downshifted: 11-10-9. We lost speed until we were doing exactly the minimum allowed the trains by the pikes: 25 m.p.h. Eighth gear put us over the summit, and we gained speed down the west slope. We

WORKING THROUGH 12 GEARS keeps Steve busy. Separate reverse lever is behind elbow. Outside mirrors can be defrosted in a few seconds. Behind Steve is bunk where the co-pilot sleeps during trips.





while Leroy (above) goes ahead with lantern, checks traffic, flags train through when safe.

crossed the great Hudson River bridge to the New York Thruway. Suddenly, at six a. m., we were in a storm—sheets of slashing rain.

“Rain bother you?” I asked.

“No. With all this weight we have tremendous traction. But wind does. With two trailers in a high wind you can lose 10 miles an hour—especially if one is a rib side with vertical struts.” This trip, *both* of ours were rib sides. I remembered that radio broadcast: *gale winds, rain turning to snow.*

We’d planned to pull into the Scotch Plains, N. Y., service area for coffee. It was crowded with rigs. Like a train pulling into a busy yard, we slid, humming softly, between lines of trucks. Steve looked in vain for room for our big train. We’d passed up a spot as we came in.

“That’s tough. I’m hungry,” he said. There was no room for us. We slid right on past the other rigs, our trailers tracking perfectly in crowded quarters. Then we were on the stormy pike again.

“Couldn’t you have backed into that first spot?” I asked. No. 7003 has a special backup lever, separate from the forward gearshift. Steve shook his head.

“Backing is one thing you can’t do with two trailers on,” he said. “This is strictly a go-ahead operation. Oh, you could back a few feet. But if we have to do much backing it’s easier to uncouple and hook up again.”

Horsepower vs. wind. The wind howled. Rain drove in slant lines. In the mirror I watched the lights of our trailers. I’d expected to see swaying; there was none.

I’d wondered: What kind of rolling-pin track do *34 wheels* make? I transferred to the escort car to see. There were exactly

four clear grooves in the rain—no more. They were straight and knife-sharp.

Back in the wheelhouse, I watched Steve upshift deftly.

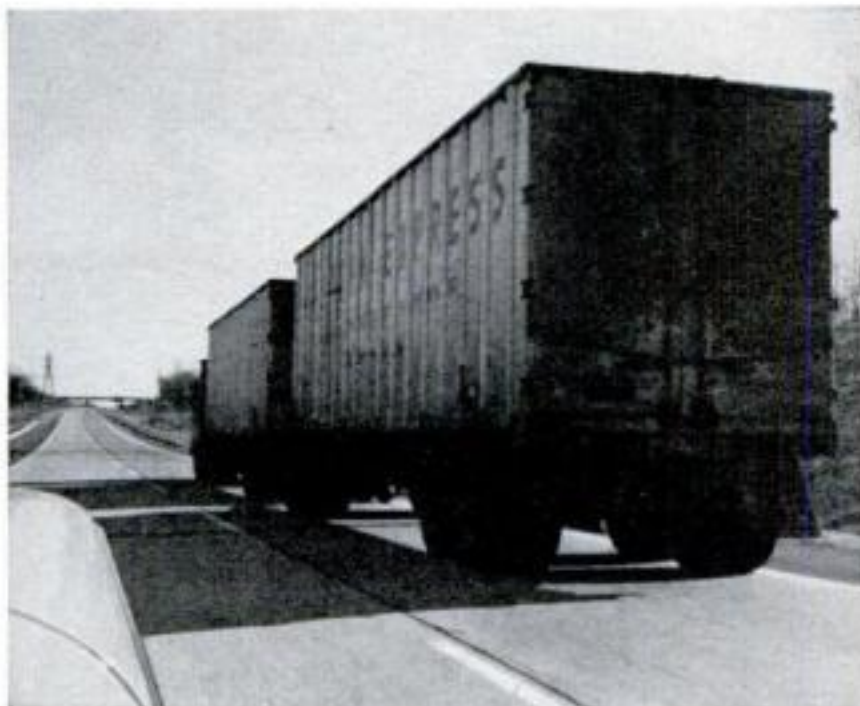
“Fifty miles an hour is our limit,” he said. “If we overrun it, the governor cuts in at 53.” Once, unintentionally, we overran it. A red light on the speed clock flashed at us. “Governor took hold there for a moment,” Steve said. “She gets mushy.”

Until now, singles had passed us easily, doing 55 and 60. Then we began to buck the storm head-on. So did the singles. Some singles today turn up 250 hp., but most have about 178. Now singles began dropping behind us steadily. We were getting the full benefit of 335 hp.

At two p. m., near Clarence, N. Y., Leroy (who was now driving) noted a change in his oil gauge.

“Cab’s warm but it must be getting

[\[Continued on page 232\]](#)



OVERTAKING CAR passes No. 7003 on Thruway. Her 335-hp. engine kept the truck rolling along when a fierce gale slowed other trucks to 35 m.p.h. Train is stable, swayless, on road.

Missile gantry grows feelers

Sensitive fingers now reach out from the giant service tower at White Sands Missile Range in New Mexico to stop it automatically before it can collide with an erected missile. Before they were added, only two persons were qualified to move the gantry into position.

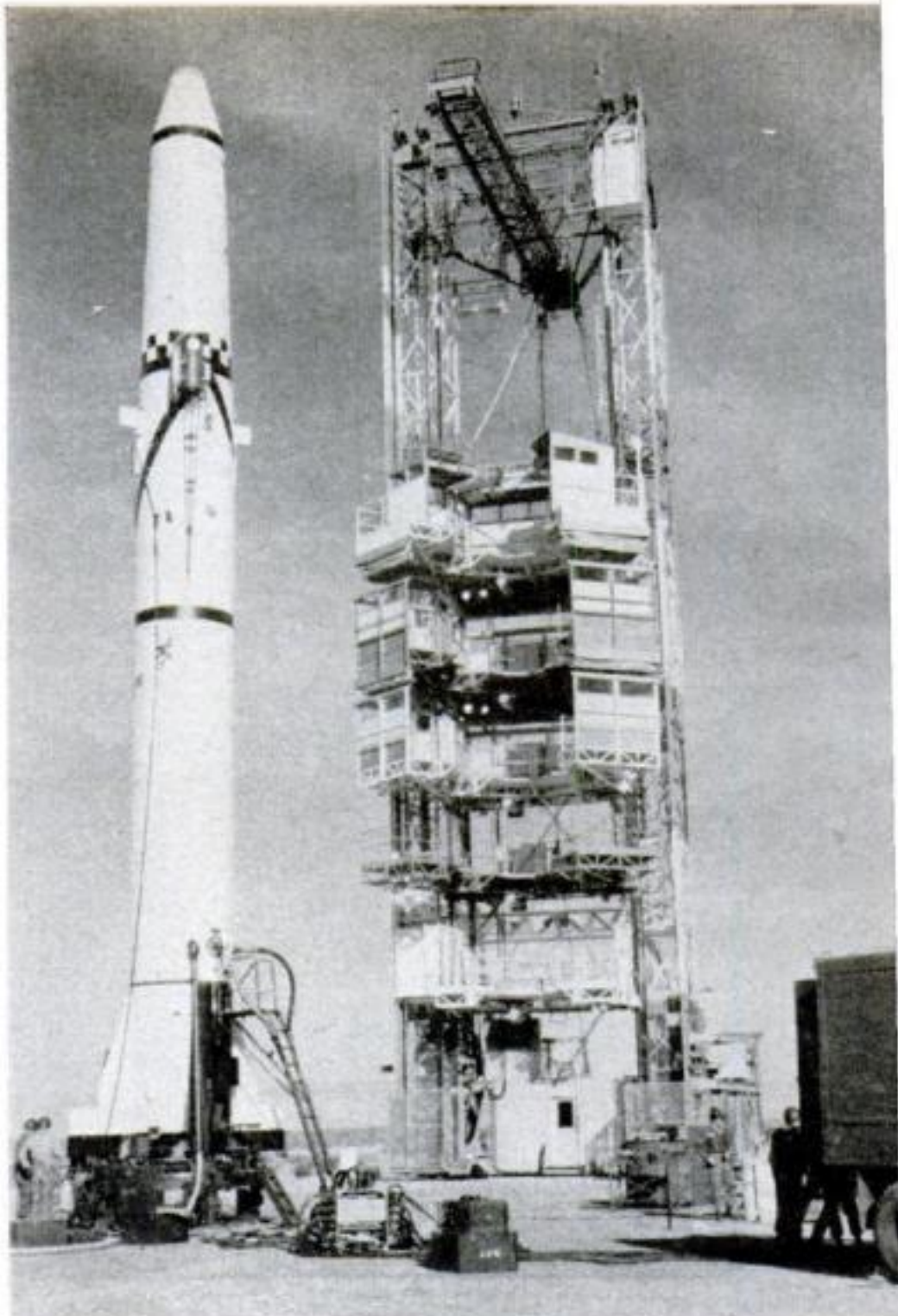
The probes—paired aluminum rods—are located near the top and close to the base. On contact, they glide back through frictionless guides. In its progress, each one passes a series of six proximity switches linked to the tower's automatic controls. Lights on a special panel in the

operating console blink out to record changes in distance between the tower and missile.

A seventh switch puts out a seventh light and brings the tower to a dead stop in 750 milliseconds—faster than you can blink your eye. The tower then can't be moved—except to back away.



GANTRY-EYE VIEW of Redstone being set between tracks on which the tower rides.



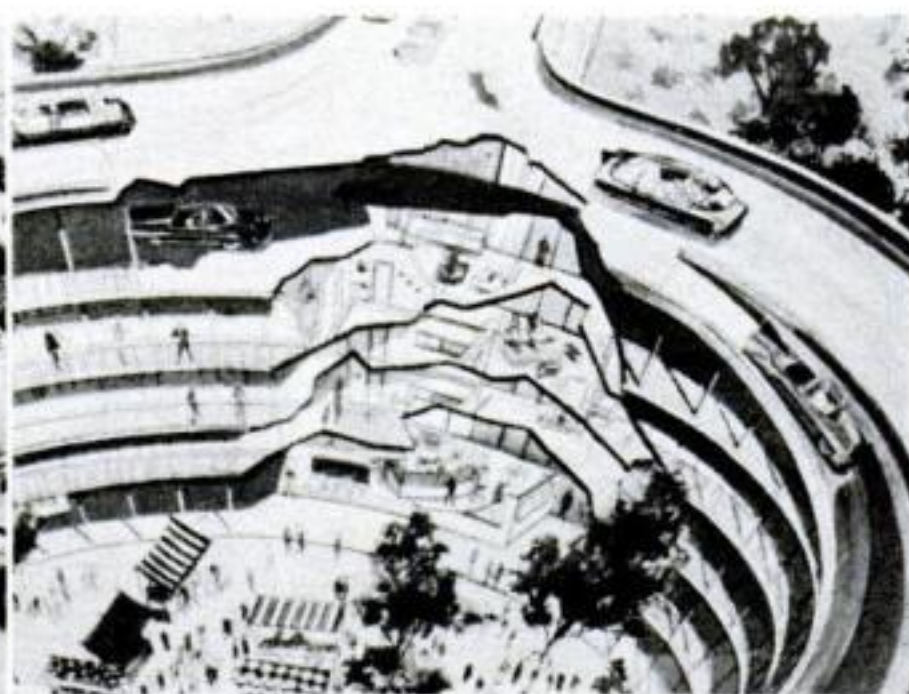
APPROACH IS DELICATE to keep gantry from going too far and pushing the missile off balance.



Highways are built on top of the buildings.

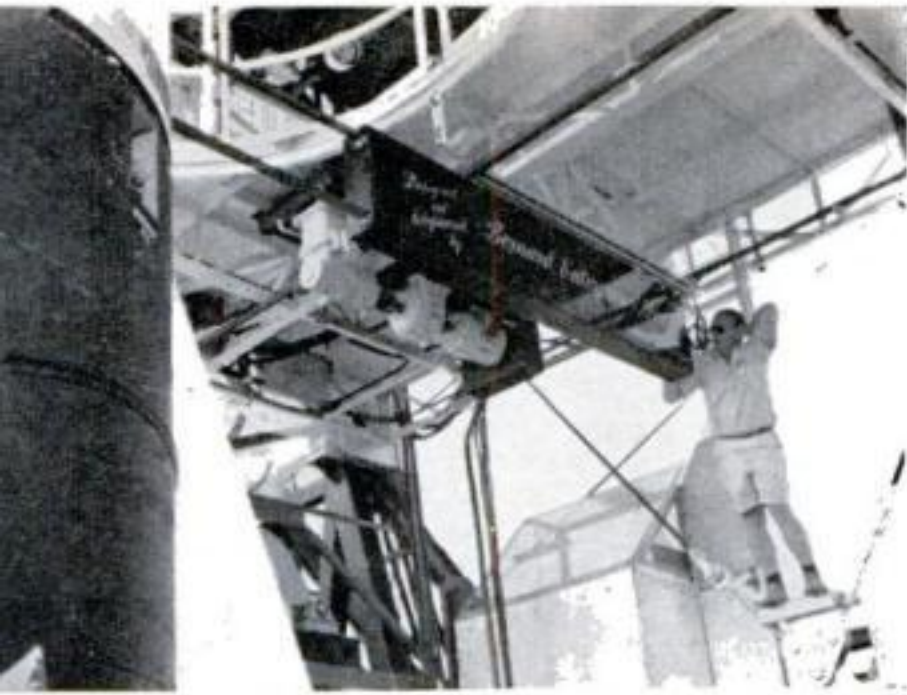
Motor town of tomorrow

Designers of a city of 30,000 people, proposed for a site 17 miles from London, have envisaged an automobile age. The streets run along the tops of the build-

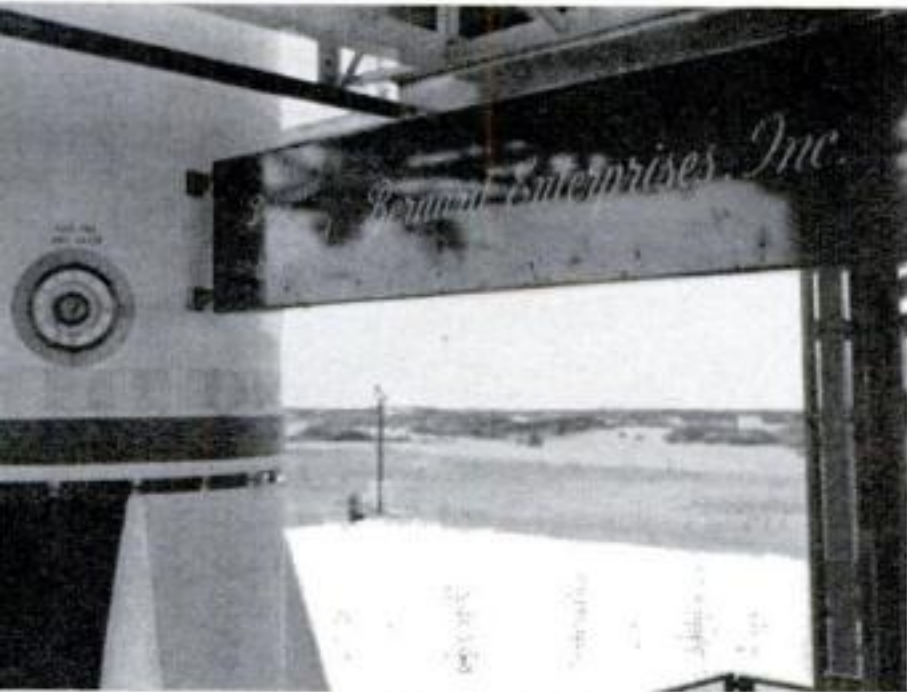


Cutaway shows life under a traffic circle.

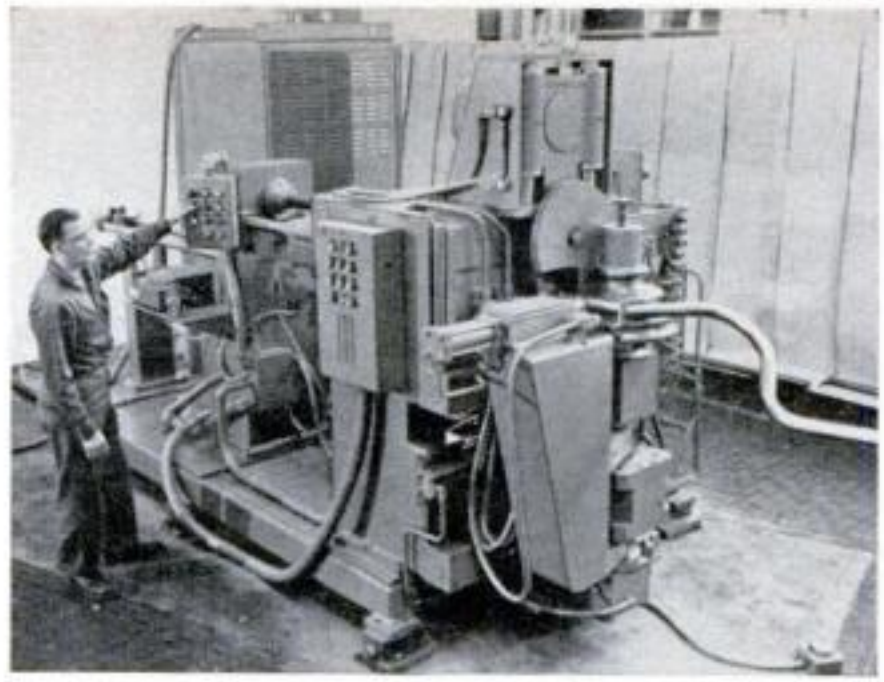
ings, which will contain homes, shops, and restaurants. Parking areas are provided off ramps on the top floors. In the areas inside traffic circles and between buildings, there will be parks, churches, schools, and community centers.



FEELERS touch missile. There are two sets: this one near the base, the other near the top.



AS RODS GLIDE back into the frame, they actuate switches connected to the tower's controls.



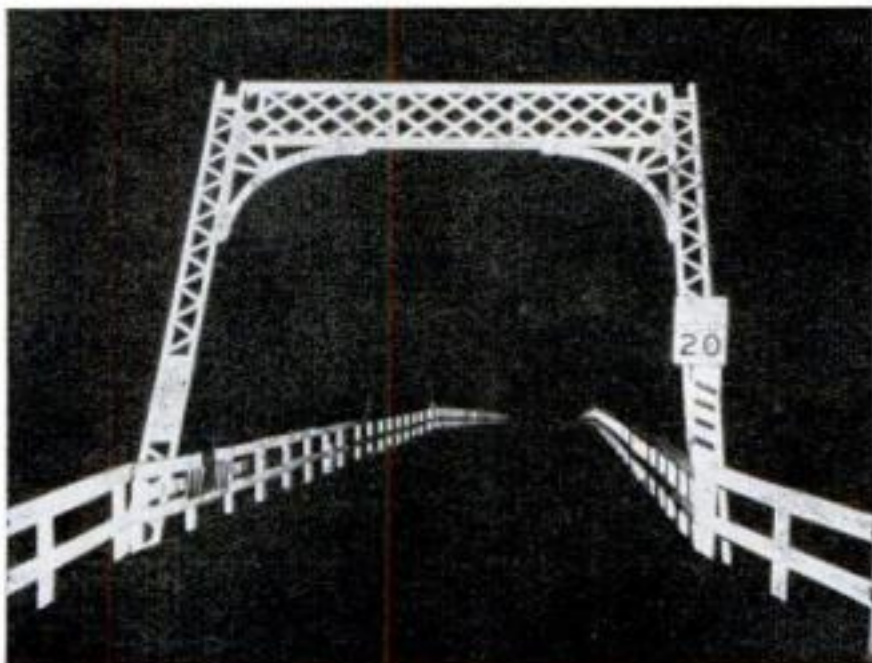
Tailpipe bender

Here's a machine that bends an automobile tailpipe to any shape from coded tape. Bend-O-Matic is intended to out-mode the stocking of different shapes for 700 to 750 car models now on the road. Put the right diameter pipe in at one end with the proper tape, press a button, and it comes out the other end in two minutes ready to install. Nu-Era Corp., Rochester, Mich., designed the machine.



Radio catcher

Like a giant catcher's mitt, this 60-foot, 15-ton dish antenna can swing in three directions, its tri-axial mount duplicating the motion of a man's wrist. Philco built it to pick up telemetered satellite signals for the Air Force.



Luminous bridge

Coated with fluorescent paint, the bridge above can't miss being seen by a driver. It glows brilliantly at night as it reflects the headlights of approaching cars. The span carries Highway 36 over the Minnesota River near Minneapolis.



EAR FOR SPACE: Big dish—85 feet across yet accurate to eighth of an inch—focuses faint radio signals on receiver. It moves up, down, and around to probe the heavens.

U.S. Begins Search for Beings in Other Worlds

*Is somebody up there? Yes, scientists now say
—and They are trying to talk to us by radio*

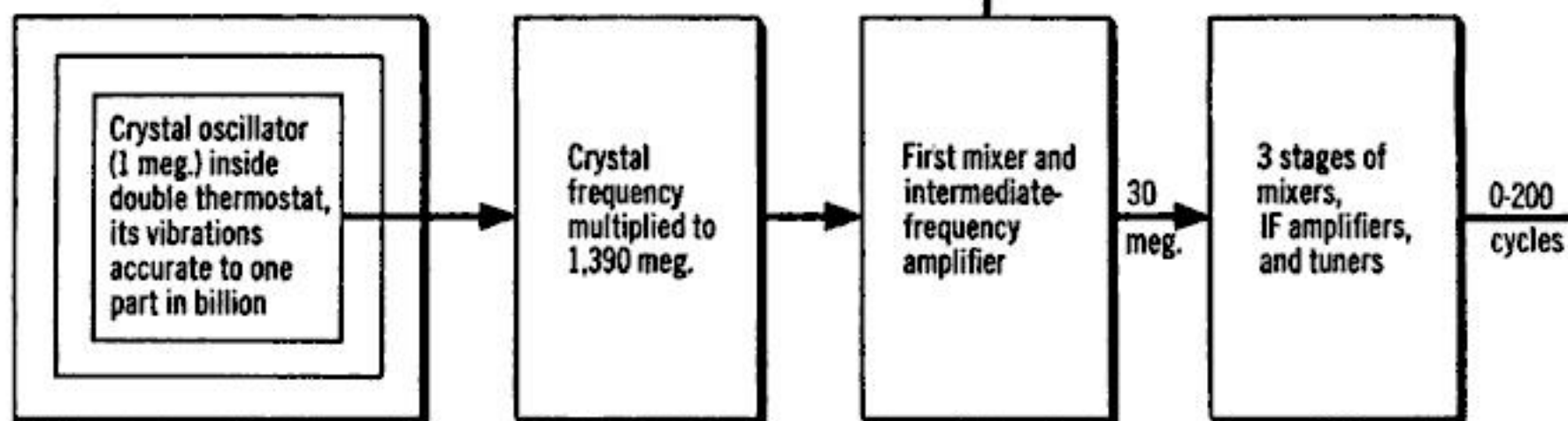
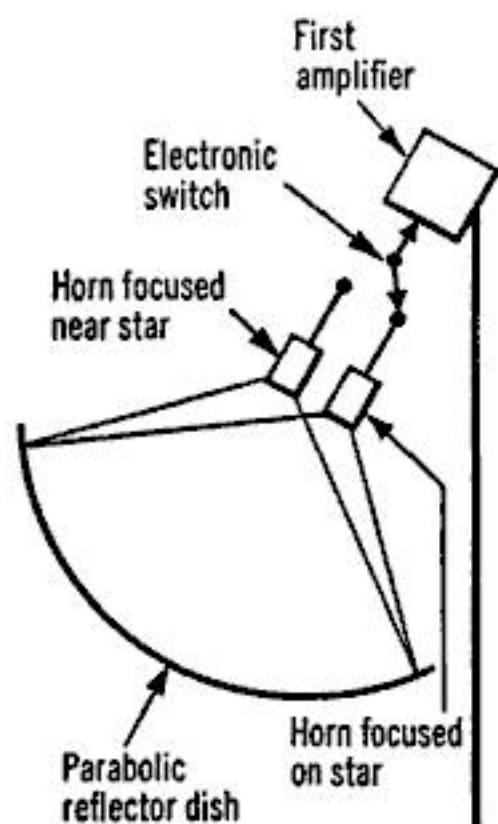
By George R. Price

RIGHT now, at a lavishly equipped laboratory in the backwoods of West Virginia, an intense, prematurely gray young scientist is twisting dials in the most extraordinary search ever made. Dr. Frank Drake is trying to tune in radio broadcasts from Intelligent Beings in other parts of the universe.

Six hours a day he points a gigantic radio-telescope dish at nearby stars and studies the squiggles its recorder traces out. One day the record will show, amidst the static from colliding galaxies and cosmic gas clouds, a momentous regularity: the first meaningful message from Beings in space.

A few years ago Dr. Drake might have been hooted out of the astronomical society for suggesting such a project. But now many scientists believe that Beings live on unknown planets of other stars, that many of Them are smarter than we are, and that They are trying to talk to us by radio. So respectable has this fantastic idea become that the U. S. Government finances Dr. Drake's search. Officially it is Project

ELABORATE ELECTRONICS will pick out real messages hidden by static. Two input horns alternately feed the ultra-sensitive receiver. One horn is focused on star, other on empty space nearby. Both horns get static (such as auto-ignition noise) but only one gets star signals. By filtering out everything that does *not* vary as receiver switches between horns, the signals coming in from the star can be separated for study.

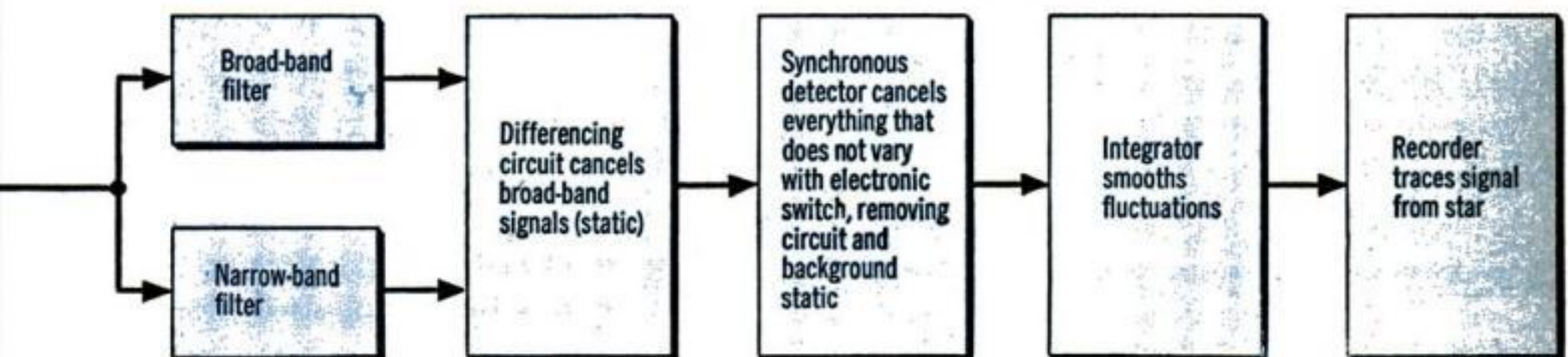




Lick Observatory photograph

UNKNOWN PLANETS, far too distant to be seen by any telescope, cluster around half the count-

less stars of the universe. Millions are probably inhabited by civilizations ahead of us.



CONTINUED

Ozma (after the mythical land of Oz), but locally it's known as Project Little Green Men.

Somebody's up there. The new respectability of hunting for little green men comes from two breakthroughs, one in astronomy, the other in biochemistry.

First of all, we now know better how planets were created. Even the nearest stars are so unbelievably distant that we can't see whether they have planets or not. The old theory was that they probably didn't. Our own planetary system was supposed to have formed when another star sideswiped the sun. Such a near-collision between stars could occur only rarely, so not one star in a million could have planets.

The new theory is that when a star is born—from vast clouds of gas and dust contracted by gravity—some of the gas and dust remain behind to form planets. That means about half the stars in the universe probably have planets.

If half the stars have planets, what is the chance that life will appear on some of them? The breakthrough in biochemistry shows that the odds are amazingly good.

How did life begin? Dr. Stanley L. Miller, then a student at the University of Chicago, performed the crucial experiment in 1953. He filled glass tubes with gases present in the earth's atmosphere when it was first formed: hydrogen, water vapor, methane, and ammonia. Then he sent an electric spark crackling through the tubes, to give the effect of lightning. The startling products: large amounts of complex organic compounds, such as amino acids, that are on the way to living matter.

Many scientists now believe that life began just that way on earth. The amino acids accumulated in the oceans to form a thin soup, and in the course of hundreds of millions of years, some molecules combined to form the first living things.

Since the universe is all made of the same stuff, other planets must have those gases, and lightning storms as well. So life can develop—and evolve into intelligent forms—on any planet that's not too hot or too cold, nor too big (excessive gravity) or too small (no atmosphere). Even if this happens only on one planet in a million, there are so many stars in

What They will look like:

Some guesses—amusing

Intelligent beings of other worlds will be animal-like rather than plant-like. They will more likely live on land than in the water. There will probably be two sexes. And they will have two or more limbs or tentacles for handling tools.

These are not wild guesses, but the reasoned opinion of a man well equipped to theorize: Indiana University's Nobel Prize-winning geneticist, Hermann J. Muller. He listed for *POPULAR SCIENCE* some of many forms beings might take:

- An upright animal resting on a tripod base of two legs and a tail, with two forelimbs developed into arms—something like a kangaroo.

- A four- or six-legged animal with tentacles like an elephant's trunk.

- A six-legged animal whose two front limbs have evolved into arms—like the centaurs of Greek mythology.

And there is a chance that on a few planets—a very few, Dr. Muller believes—there will be beings with two legs, two arms, and a head at the top; creatures that would look like men from a few hundred feet away. But as for creatures that would look human from close up, as in the science-fiction tales where the Earthman falls in love with the beautiful blonde from Betelgeuse—that, Dr. Muller says emphatically, "is about as ridiculous as to imagine they speak English."

.....

the universe that there may be billions of planets supporting life.

Our sun appears to be about average age for a star, which makes us earthlings about average. Half the civilizations of other worlds should be older, and therefore ahead of us.

Long ago the star people will have invented radio—and become curious about civilizations around other stars, including that modest one near the edge of the Milky Way, our sun. For thousands of years They may have been beaming a message our way, patiently waiting a reply to tell Them that "a new society has entered the community of intelligence."

What's he say? Fantastic as it seems, Dr. Drake already knows where on the dial to fish for Their radio broadcast. He is even prepared to tell us what They may say.

and serious

MEN ON THE MOON: This is H. G. Wells' conception sketched by artist Irving Geis.



SEXY BLONDES—like Rhea, a space siren foiled by Flash Gordon—are a staple in the comics, but not to be expected on any real planet.



TREE MEN were drawn by R. T. Crane for Kenneth Heuer's book "Men of Other Planets." These are unlikely.



WEIRD CREATURES are W. R. Leigh's illustrations for article, also by Wells, in 1908 "Cosmopolitan." These could exist.



© 1949 Hugo Gernsback

BUG-EYED MONSTER was dreamed up by Hugo Gernsback, whose science-fiction has proved prophetic.

Two Cornell scientists, Drs. Giuseppe Cocconi and Philip Morrison, figure the Beings are transmitting on a wave length of 8.5 inches. They reason: 8.5 inches is the wave length given off by hydrogen atoms in interstellar space. It's fairly easy to receive, and it's always being studied by sky-probing radio astronomers. Intelligent Beings on other worlds would know that.

One message They may send, say Drs. Cocconi and Morrison, is couched in the universal language of mathematics: the prime-number series 1, 2, 3, 5, 7, 11, 13, 17, etc.

It would come out of a loudspeaker as hissing beeps, or appear on a recorder like this:



Such a message would make it clear

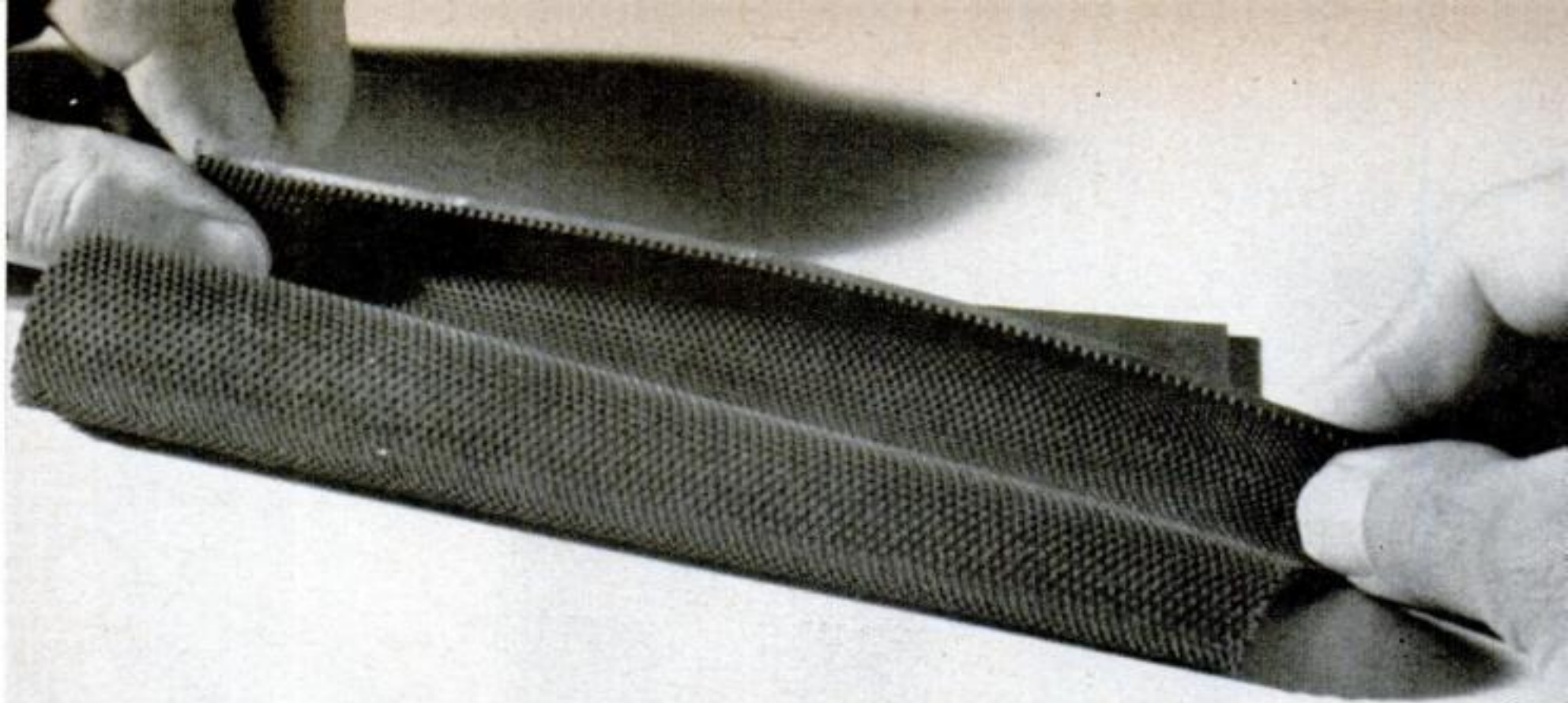
that the radio signals were controlled by Intelligent Beings, and were not the result of any strange natural process.

Another sort of message, suggests Dr. Drake, will be television pictures of simple objects, plus the names for the objects—to teach us Their language.

Headquarters for a space hunt. A few weeks ago Dr. Drake showed me around the National Radio Astronomy Observatory. Its antenna, eerily sweeping the sky, and lab buildings lie in a natural amphitheater of Deer Creek Valley amidst the rugged beauty of the Allegheny Mountains. The pastoral site was selected for its mild weather and its remoteness—far from the static generated by city machines—just like Sugar Grove 30 miles away, where the Navy is building its giant 600-foot radio telescope [PS, Dec.].

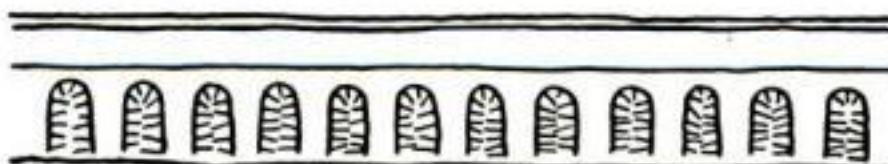
Sprouting high from a pasture is

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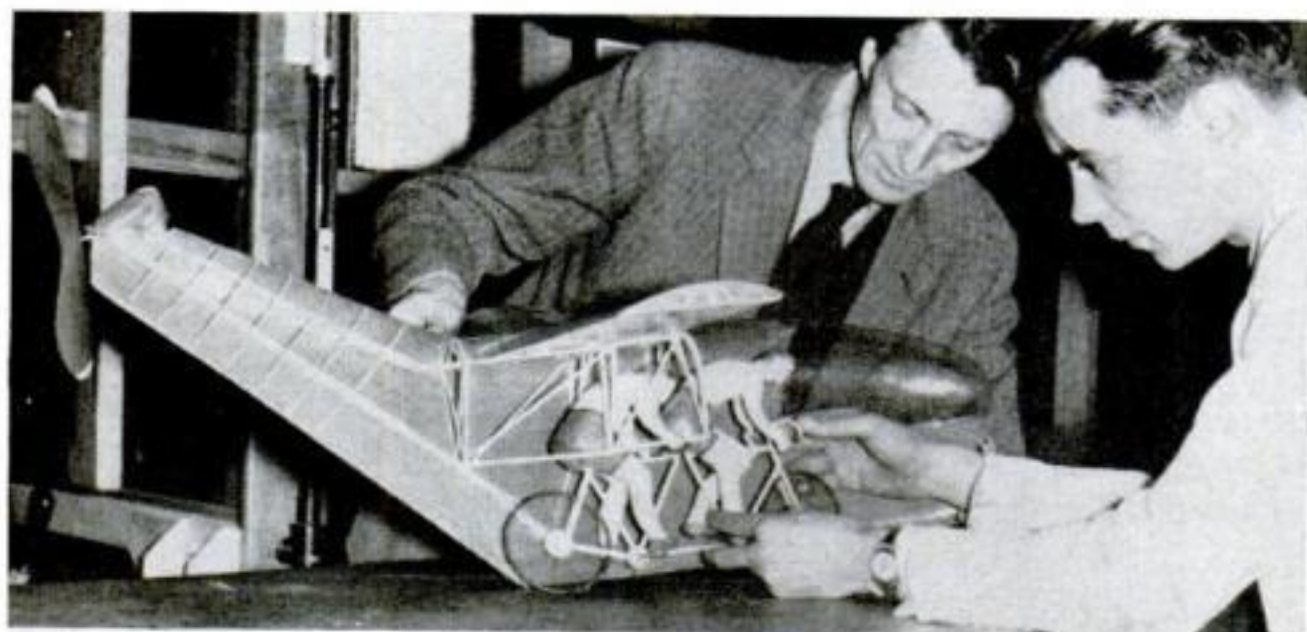


ARTIFICIAL RUBBER SKIN, glued to a boat with its short stubs against hull, forms a watertight coating. Liquid circulates between stubs.

Man-Made "Porpoise Skin" Promises to Double Boat Speeds



SKIN OF A PORPOISE ripples when the mammal swims quickly (left). Under a microscope, Dr. Kramer found that the top 1/16-inch of skin has water-filled ducts (above). These change shape under pressure, make the skin resilient.



Leg-powered flycycle

Engineering students in Northern Ireland's Queens University have now built a model of Terrence Nonweiler's flying bicycle we told you about in the October issue.

A full-scale tandem flycycle would provide power by turning a sprocket-linked rear propeller. The men would build up speed, release a clutch for takeoff. Air speed of 35 to 45 m.p.h. is hoped for.



SPLIT MODEL shows cyclists on bike in flycycle. Designer Nonweiler is at left.

FINISHED plane, with fuselage enclosed, will look like this.



40-M.P.H. TESTS of rubber skin are run in Los Angeles harbor. Wrapped around the front section of a torpedo-like test rig, the skin showed

50 percent less drag than a smoothly polished metal surface. Rig is towed completely submerged, away from propeller turbulence.

Submarines, torpedoes, and planing-type boats could double their speed—without using more power—if turbulent waves didn't cause friction between hull and water. Knowing this, Dr. Max Kramer, a Los Angeles engineer, has been experimenting for many years with hull coatings that would dampen the turbulence by absorbing its energy.

Nothing worked until, on an ocean voyage, Kramer watched porpoises race by. According to his calculations, they shouldn't have been going so fast—unless nature had solved the turbulence problem for them. Curious, he later exam-

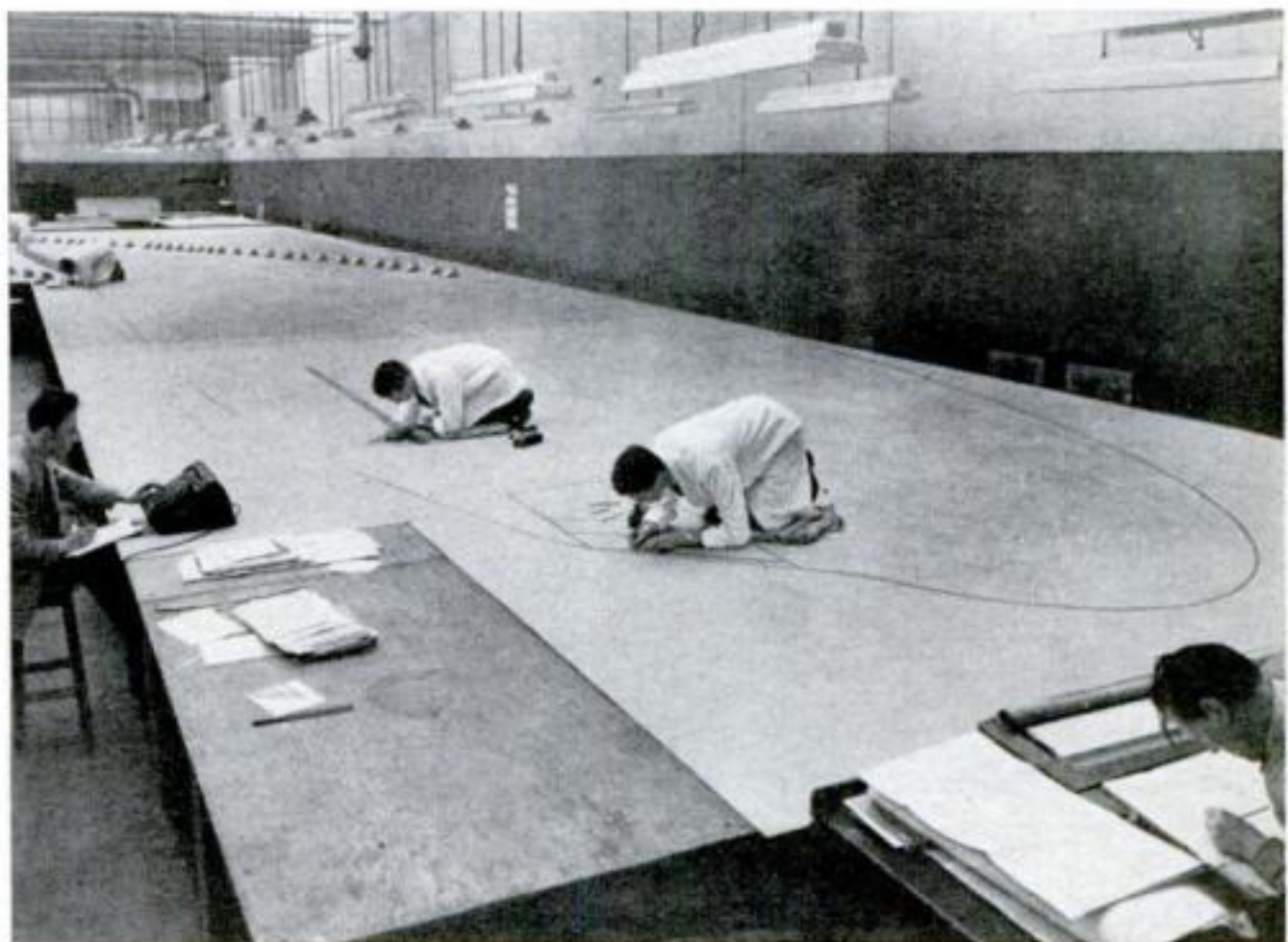
ined a slice of porpoise skin under a microscope. Kramer found it porous, with water-filled ducts that change shape to absorb the pressure of turbulence against the outer skin.

That was in 1956. A year later, as vice president of Coleman-Kramer, Inc., he joined forces with U. S. Rubber Co. They developed an artificial porpoise skin called *Lamiflo*. It's smooth on the outside, has closely spaced stubs that go against the hull. A silicone damping fluid is injected into the stub space before it's sealed. By year's end they'll try out a *Lamiflo*-coated runabout.

Getting down to work

On hands and knees, draftsmen at Short Bros. & Harland in Belfast lay out on metal a full-scale template of the fuselage of a new 136-foot *Britannic* air freighter.

The process is known as lofting, from the early shipyard practice of preparing full-scale drawings in lofts. Short was a leading British firm to adapt it to plane design during World War II.



Driving Chrysler's Stick-Shift 300F

A real man's car, this four-speed, 400-hp. behemoth is exciting and roadable—if not the ideal family car

By Ken Fermoye

I JUST finished a two-day session behind the wheel of a new Chrysler 300F with a shift-it-yourself, four-speed gearbox and 400 horses under the hood—and it was a wrench to part with it.

This is a man's car—big, muscular, and fast. It's handsome; not tricked-up, not cute. Its ride isn't boudoir-soft. Even its interior, split by an 11-inch-high console, discourages togetherness.

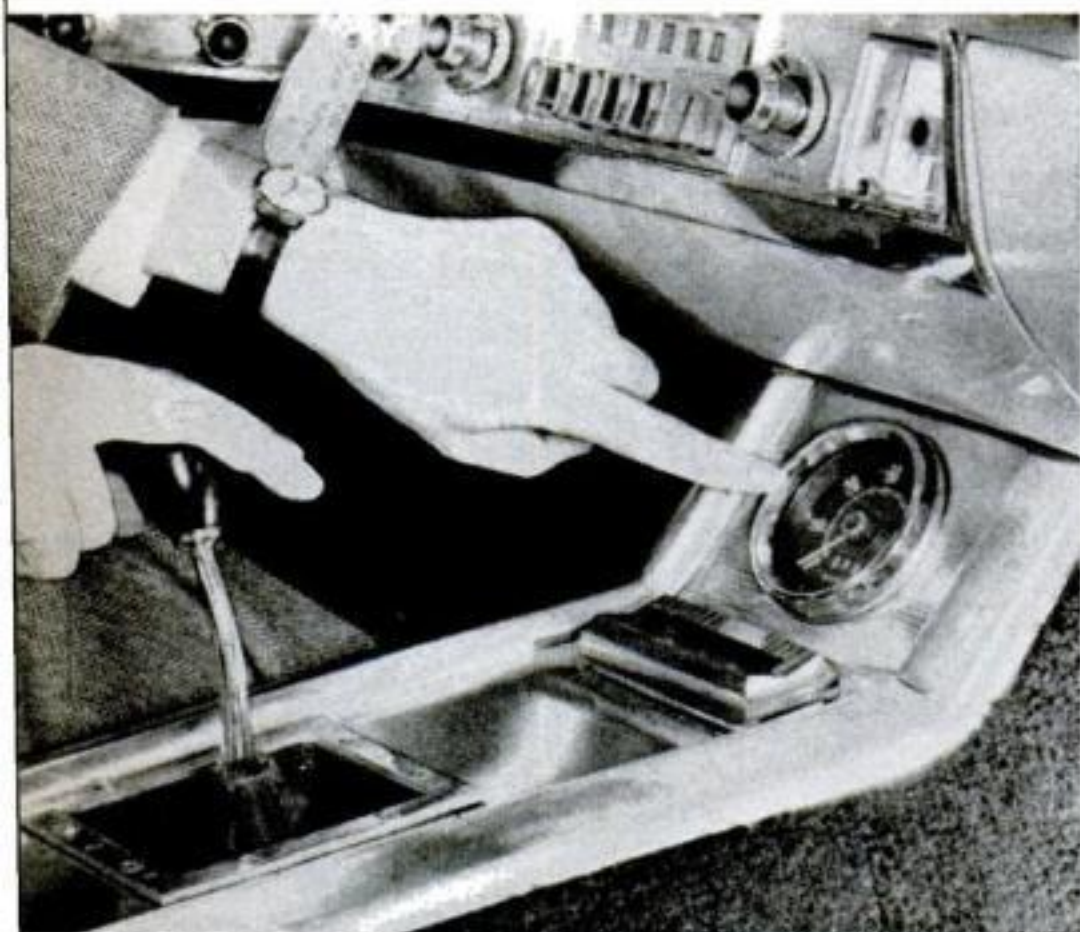
I was introduced to the stick-shift 300F four-passenger hardtop in the Chrysler-Imperial Division garage in Detroit by engineer Frank Jenkins.

"This is an engineering prototype, the first job with the Pont-à-Mousson transmission, so it varies from production models in several respects," he said.

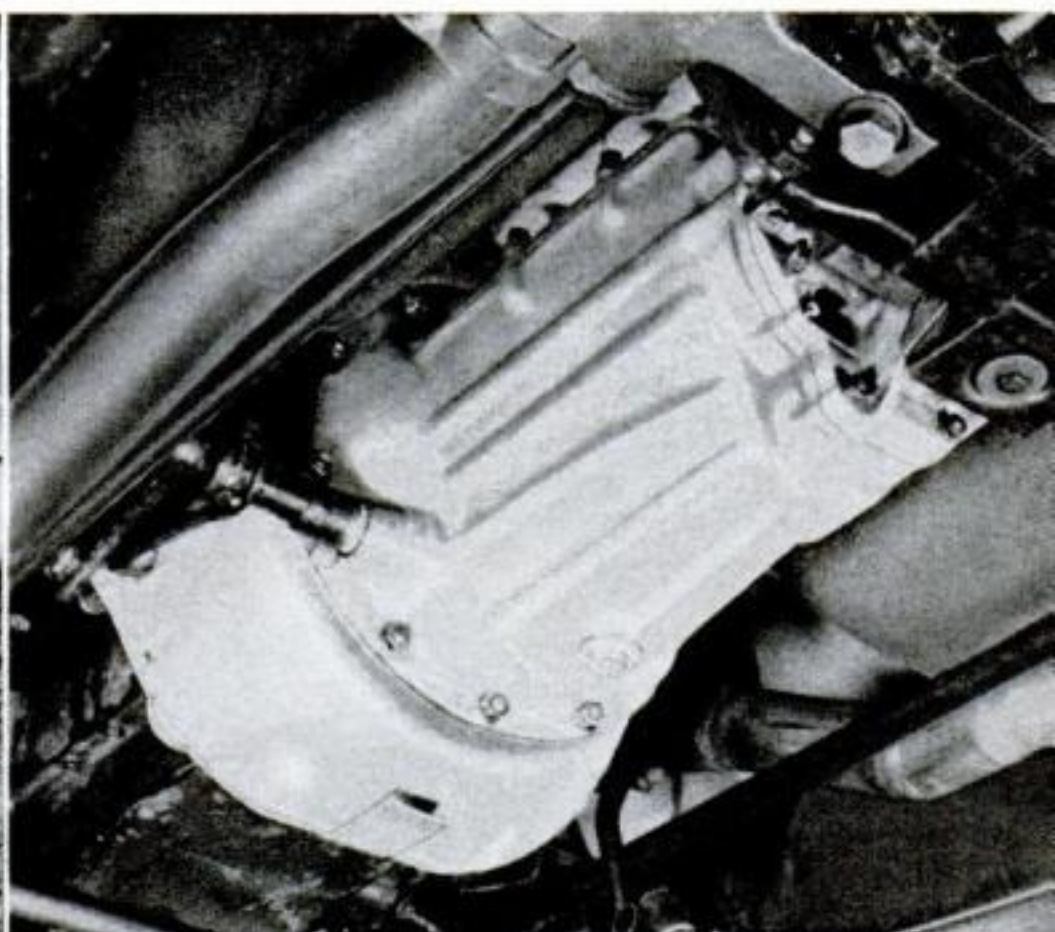
He explained that the shift pattern of the French-made transmission—also used



"Who needs pavement?" asks



Yes, that's a tachometer, but you need a third eye to see it down there. Oh well, the gearshift lever works fine.



Next to Brigitte Bardot, this Pont-à-Mousson gearbox is the greatest thing to come out of France in a long time.



Detroit editor Fermoye, as 300F blasts through a soggy turn like a real mudder.

in the costly, luxurious Facel-Vega—is the standard H-shape found in most four-speed cars.

“First is where reverse is in a three-speed box. Second, third, and fourth correspond to normal first, second, and high. Reverse is all the way to the left and up, next to first. It has a strong spring to prevent drivers from hitting reverse accidentally when they mean to select first.”

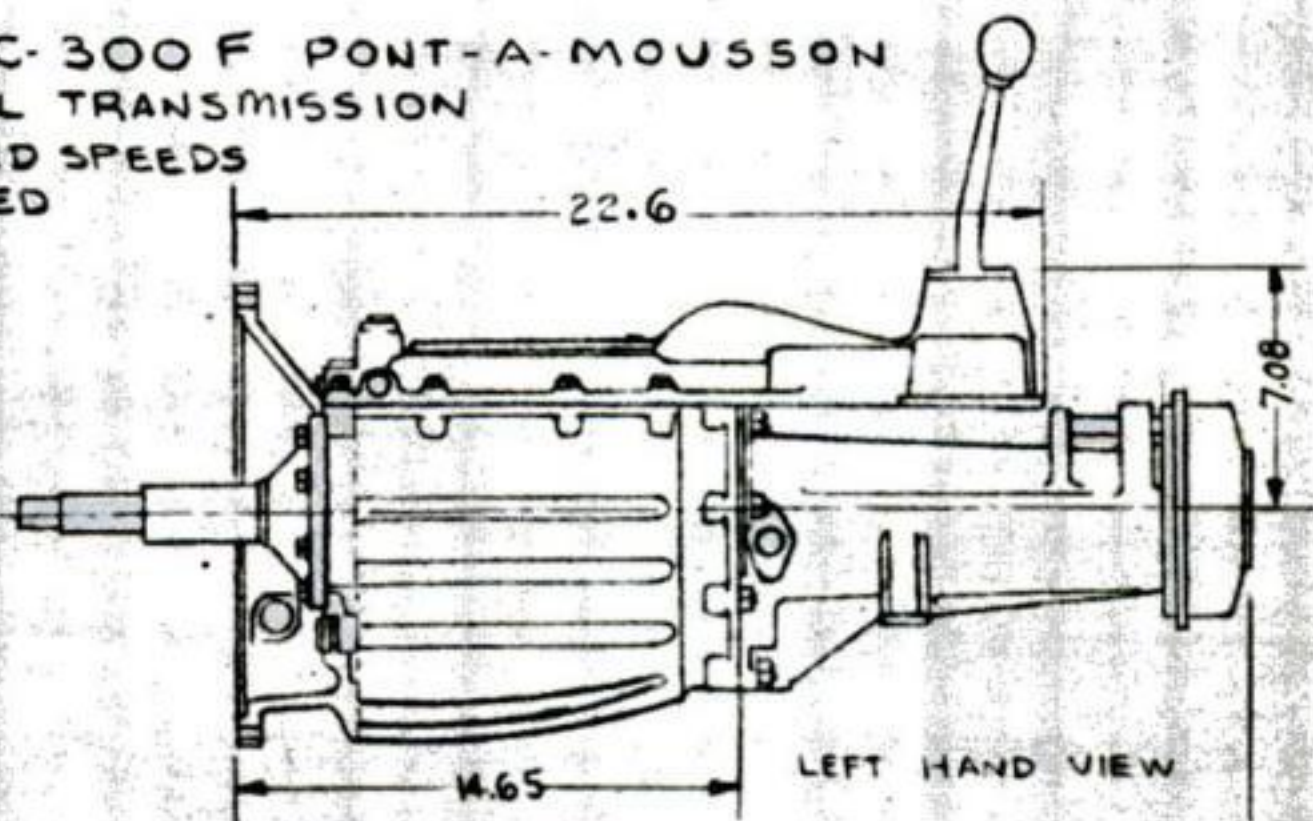
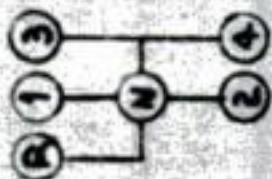
I waggled the lever back and forth experimentally and got a short briefing on the other controls. Then Frank turned me loose for two days of real driving.

The roads were dry, but snow was threatening as I headed for a stretch of little-used highway to check on the acceleration.

The big, heavy car—it weighed almost 4,800 pounds with me aboard—consist-

**CHRYSLER C-300 F PONT-A-MOUSSON
4 SPEED MANUAL TRANSMISSION
ALL FOUR FORWARD SPEEDS
FULLY SYNCHRONIZED**

GEAR RATIOS	
1 ST GEAR	3.35
2 ND GEAR	1.96
3 RD GEAR	1.36
4 TH GEAR	1.00
REVERSE	3.11



This is how the gearbox looks on a blueprint. Turn the page sideways and you'll see where each gear position is in the little shift pattern drawing in the lower left corner. A strong spring keeps you out of reverse when you mean to hit first gear.

CONTINUED



So this is where those 400 horses are stabled. There's an impressive amount of plumbing that almost hides the engine, but it's in there, all right.

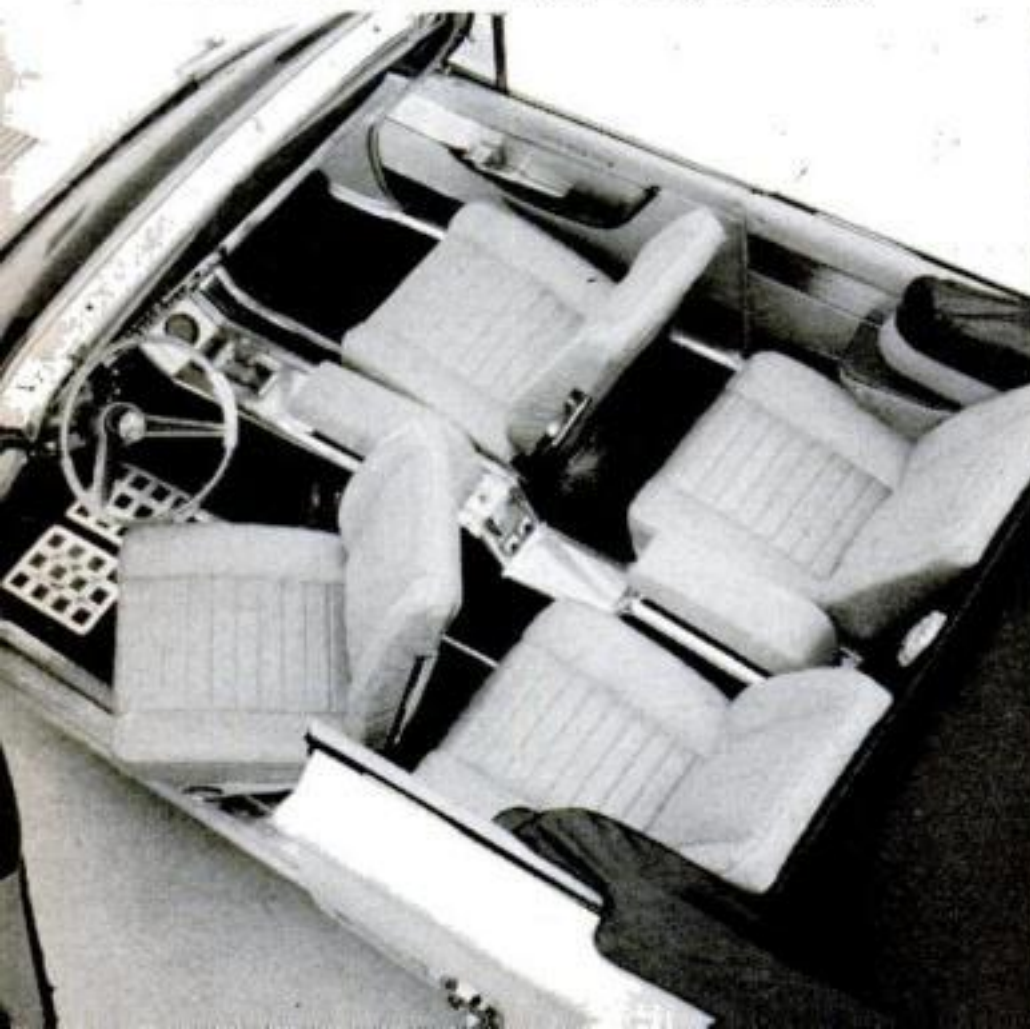
ently churned from a standing start to 60 m.p.h. in 7.2 or 7.3 seconds, using just first and second gears.

That's good, but listen:

The car had the lowest numerical rear-axle ratio offered for 300Fs—2.93:1. The standard 3.31 axle would have chopped the time by at least a few tenths.

(Any of the other axle options—3.15, 3.23, 3.54, or 3.73—would also improve acceleration. With the 3.73 installed, a 300F should climb walls, if you keep the r.p.m. in the peak-torque range.)

I didn't drive this 300F convertible, but I'd sure like to. The contoured, leather-covered seats are the same as those in the hardtops. Very classy.



In addition, the engine had just 2,000 miles on it at the time, so it might still have been a little stiff.

The car doesn't get off the line wildly fast, but at about 2,000 r.p.m. (roughly 40 m.p.h. in second gear) it starts to storm.

I had driven a 300F with automatic transmission and the standard 375-hp. engine earlier and it seemed faster up to 35 or 40 m.p.h., but it took eight seconds to get to 60.

Torque vs. horsepower. The 400-hp. engine is a poorer low-speed performer because modifications responsible for the extra 25 horses cost torque and raise the engine speed at which the torque curve peaks. The 375-hp. engine delivers 495 pounds-feet of torque at 2,800 r.p.m. and the 400-hp. V-8 gives 465 pounds-feet at 3,600 r.p.m.

Here's why:

- The 400's camshaft is hotter. It lifts the valves higher and keeps them open longer. That's great for horsepower, but it plays hob with torque (and with fuel economy).

- The effective length of the ram-induction fuel pipes is shorter (15 in. vs. 28 in. for the standard engine). That raises the engine speed at which the pipes provide momentum to the fuel-air mixture and cram more of it into the cylinders.

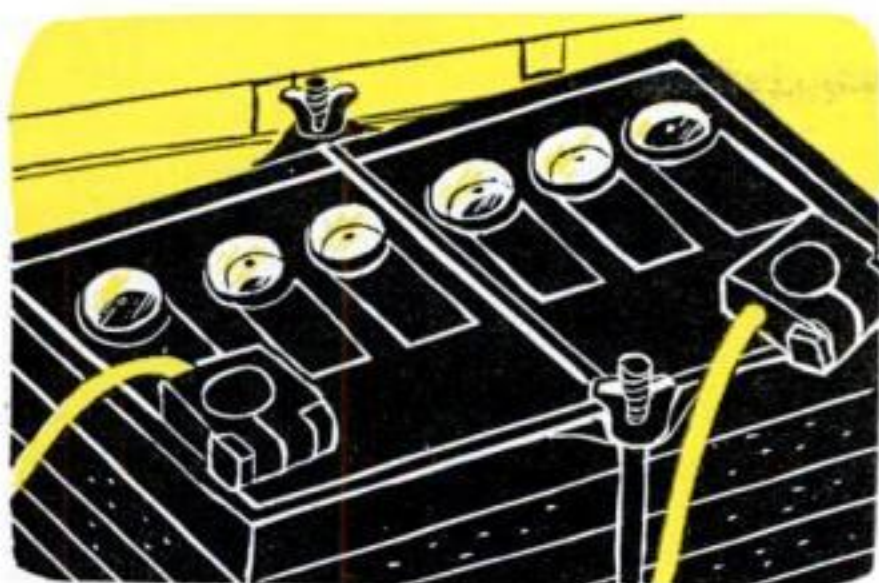
Still no snow, so I headed for the boondocks to check handling. A few hours

[\[Continued on page 210\]](#)

Man, this 300F has everything; press a button and get ejected automatically. Sure takes a lot of the struggle out of boarding and leaving such a low car.



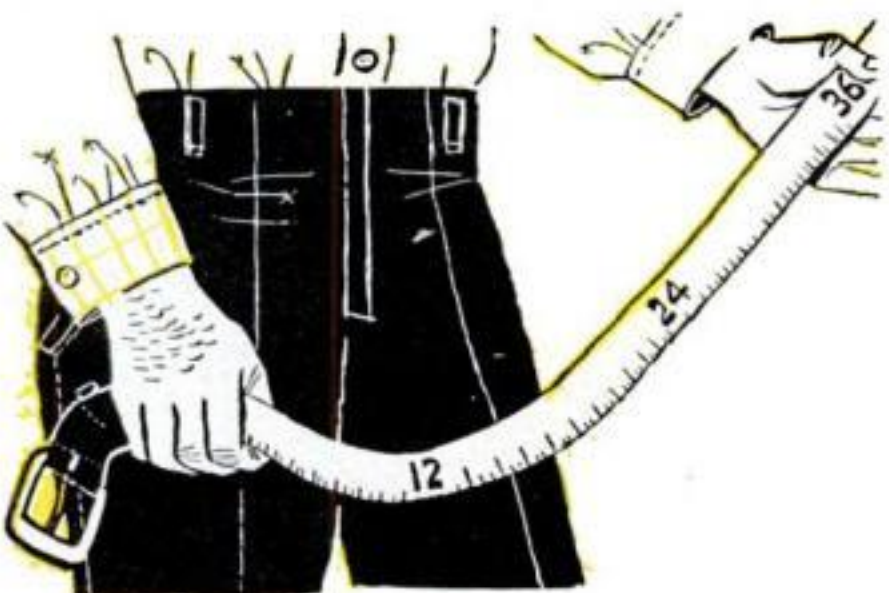
"I'd like to see them make..."



TRANSPARENT BATTERY CAPS so you could see whether or not a car battery needed water without removing the caps and without soiling your hands.—*Kay Gordin, Derby, Kan.*



A MILK-BOTTLE LID with a short spout. When the bottle was opened, it would fit over the top in place of the paper cap to make pouring easier.—*G. A. Alexander, El Cajon, Cal.*



A YARDSTICK that's always handy. Most men wear a belt that is at least a yard long. Why not print measurements on the reverse side?—*M. J. Pelsang, West New York, N. J.*



HOT-WATER TANKS you could reach into. Use a drain-off tap with a threaded end six inches in diameter. Unscrewing it would provide a clean-out opening.—*Andy Vena, Philadelphia.*



A RAIN VEIL on umbrellas to save a lady's hair-do. The transparent plastic could be dropped inside the umbrella before closing and furling it.—*D. J. Seigel, Flushing, N. Y.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's

yours? We will pay \$5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

Driver's-eye photos show how



Hazards on city and suburban streets and on throughways, as seen through your own windshield, are the subject of two classroom strips of transparencies now in use for safe-driving instruction. Some of the situations are shown below.

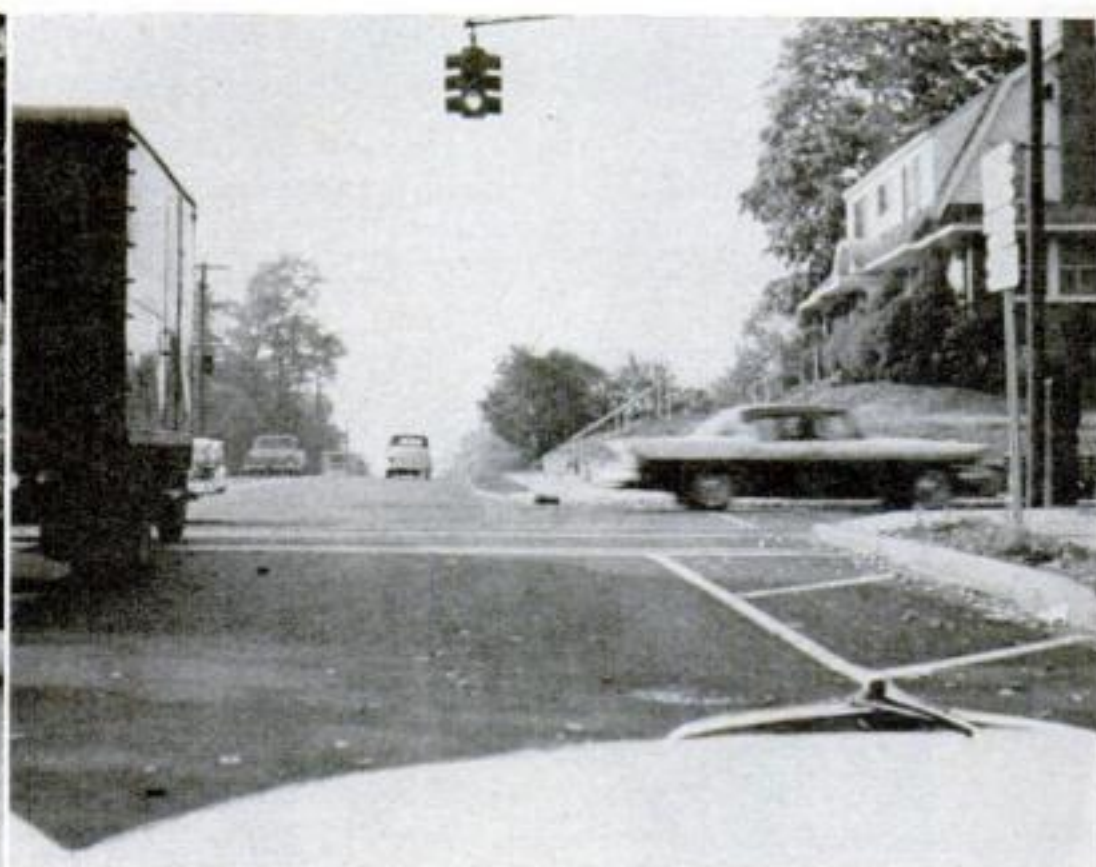
Each picture is flashed on a screen for

◀ **HOW PHOTOS WERE TAKEN:** Camera mounted in front of windshield snapped driver's-eye view.

... on city and suburban streets



WHERE THERE'S A BALL, look for a child—he's running for it between double-parked cars.



OBSCURED BY TRUCK at left, a car is speeding to beat a traffic light that has changed.

... on limited-access highways



LOOKING AT THE SEAT instead of at the road, the driver at left doesn't see that the car ahead is about to swing over into his lane.



AT SUPERHIGHWAY ENTRANCE, will the slow-moving truck wait for traffic to pass or crowd it over into your lane? It may be a hazard.

accidents happen

a few seconds, then cut off. Members of the class are asked to spot the hazard shown and to tell what action should be taken to avoid an accident. In most cases it's simple: be ready to apply brakes.

Film strips and instructors' manuals were prepared by Shell Oil Co. for New York University's Center for Safety Education. A third series, driving on secondary roads, is being produced.



FLAGGED BY A MAN at the corner, the taxi at left is about to turn in toward the curb.



BACK-UP LIGHTS ON, the car at right has overshoot its exit and is backing up to it in your lane—a frequent cause of accidents.



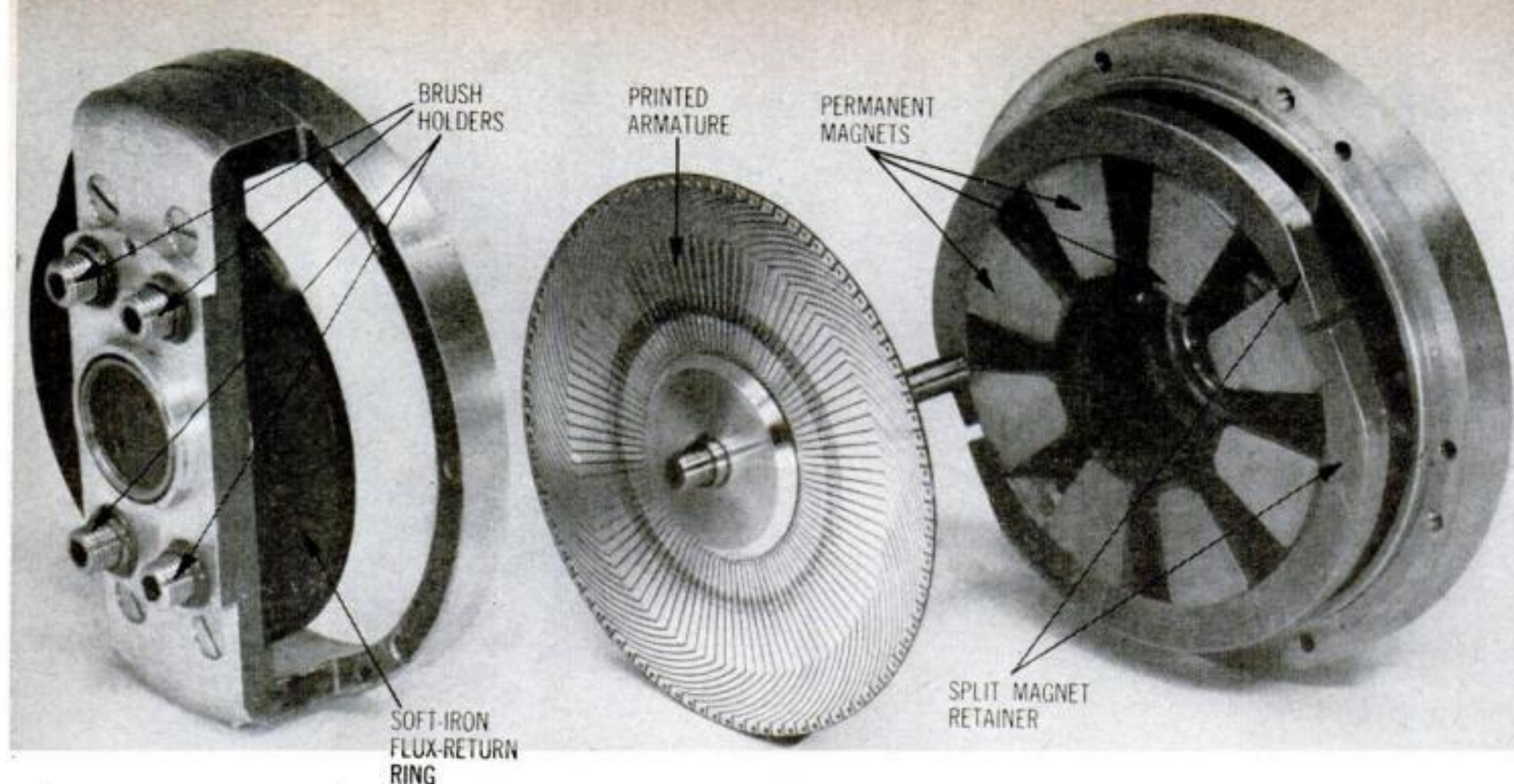
Deadly antitank weapon

Cobra, a light, one-man missile capable of knocking out any tank, is being tested by the Marines. It weighs only 20 pounds, needs no launcher. Carrying a shaped-charge warhead, the rocket is wire-guided in flight from a small electronic control box and is reported accurate up to a mile. It was developed in West Germany.



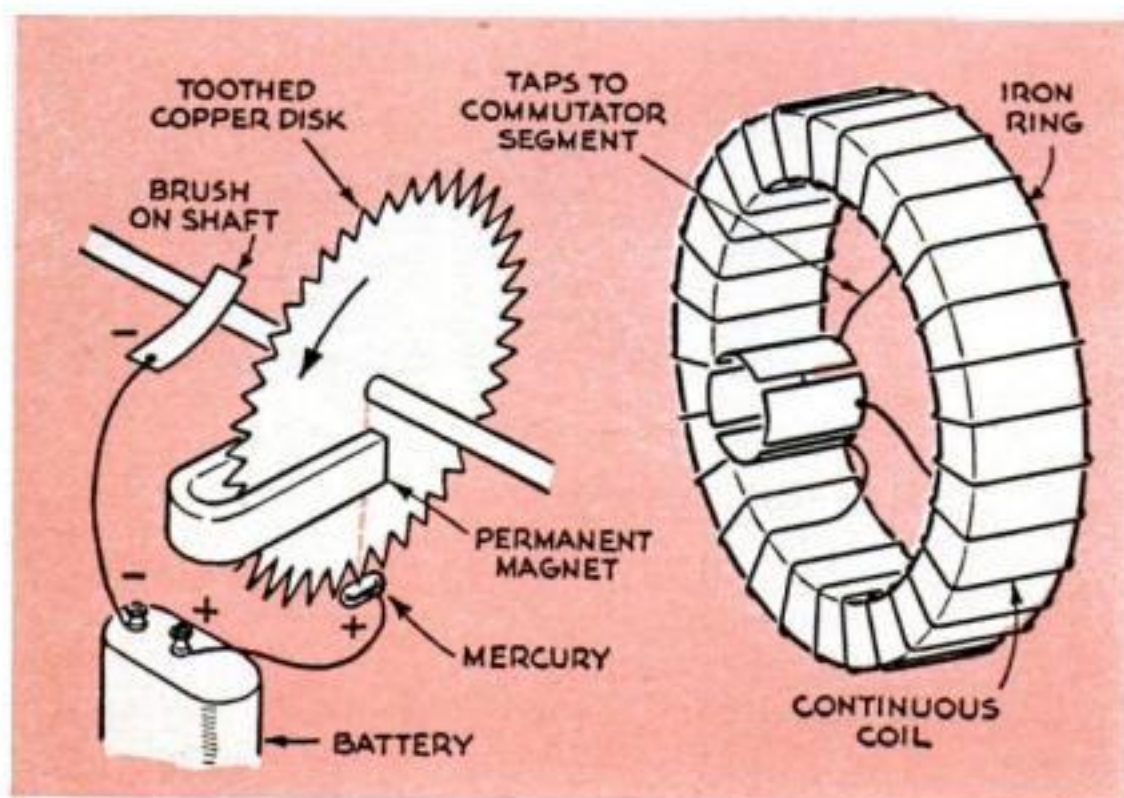
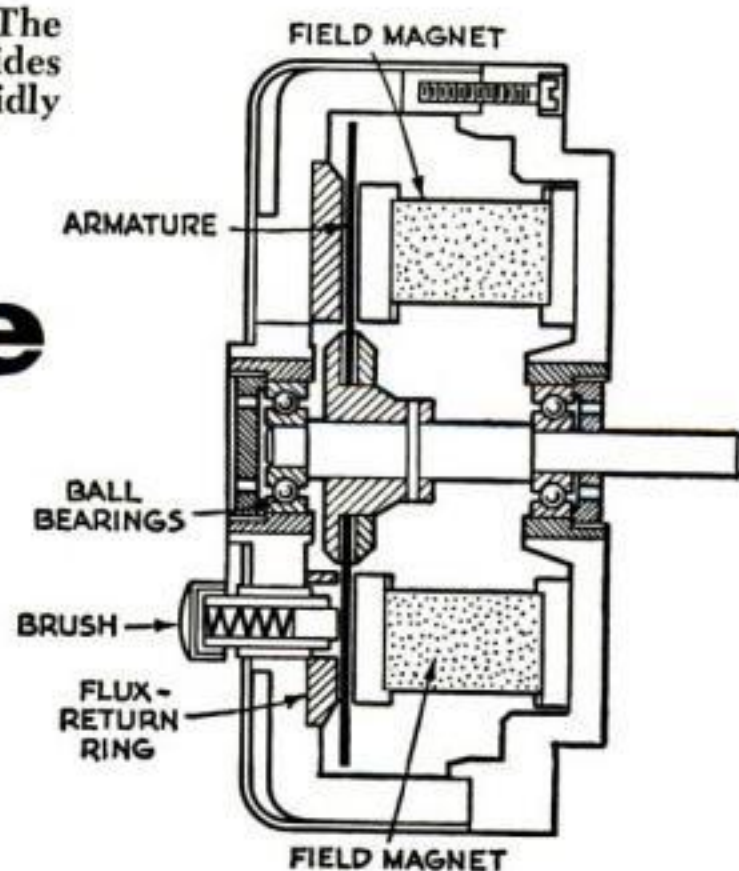
Turn signals on ship

Lighted arrows on the bridge of this ship, as well as its whistle, indicate a turn to starboard. They warn an approaching pilot like the turn signals on the front of an auto. The system, invented in the Netherlands, is being tried out in the United States by the Military Sea Transport Service.



PRINTED-CIRCUIT MOTOR ELEMENTS and how they fit together. The armature disk turns between flat pole faces and a ring that provides a return circuit for the magnetic lines of force. Ball bearings rigidly limit end play. This eight-pole motor has four brushes,

New Pancake Motors Have Printed Windings



BUT DID IT RUN? Barlow's wheel (far left) was a primitive demonstration of the DC motor principle. It ran feebly and soaked up current. Juice flowed between the shaft and the tooth dipping into the mercury pool—an ingenious low-friction contact.

Gramme's ring armature (near left) had in effect a continuous winding on an iron ring. In practice, it was often formed of separate coils. That part of the winding inside the ring was largely ineffective, and the air gap between field poles and armature core was large. The drum armature superseded Gramme's ring.

Radically different, paper-thin armatures may put gearless motors in your next car's wheels

By Harry Walton

ZIGZAGGED with lines of copper, the plastic disk was 10 $\frac{1}{4}$ inches across and less than 1/16 inch thick. I held it easily on one finger.

It was the armature of a radically different sort of electric motor. Mounted on a shaft and spinning between alnico field magnets, this cardboard-thin disk will develop about three horsepower.

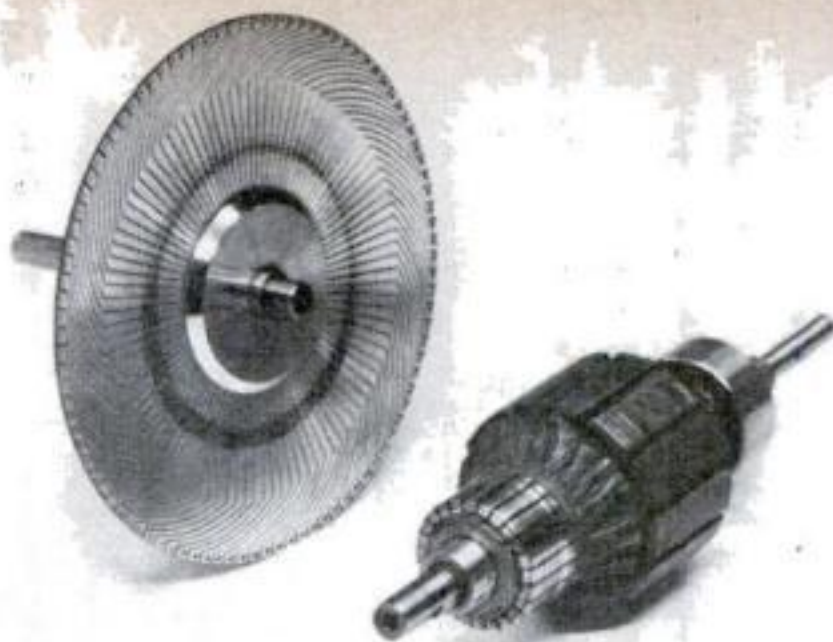
Its torque is so tremendous that four such motors directly coupled to the wheels of an automobile, or even built into them, would drive it. No gearing or transmission would be required.

Ever since Thomas L. Davenport, the Vermont blacksmith, cobbled up the first direct-current motor in 1834, we've done little more than streamline his idea. Whether built for locomotives or windshield wipers, DC motors have been chunks of ironmongery wound with wire. There hasn't been a new idea in them for 120 years.

Boiling down a motor. Now two French electrical engineers have thrown out the rotating iron, boiled the winding down to a printed circuit, and eliminated the commutator, wire, and insulation. In exchange, they've gained:

- A compact new pancake shape. The new motors are smaller and lighter.
- Terrific torque, often permitting direct, gearless drives.

CHIEF FUNCTION of conventional iron armature (near right) is to decrease the air gap between field poles. If armature coils were wound on a nonmagnetic core, field between poles would be very weak. But armature teeth bunch and deform magnetic flux as they turn, cause vibration and losses. In a printed-circuit motor (far right) the gap is slightly larger but flux is uniform and there are no hysteresis losses. (Gap is exaggerated in drawings.)

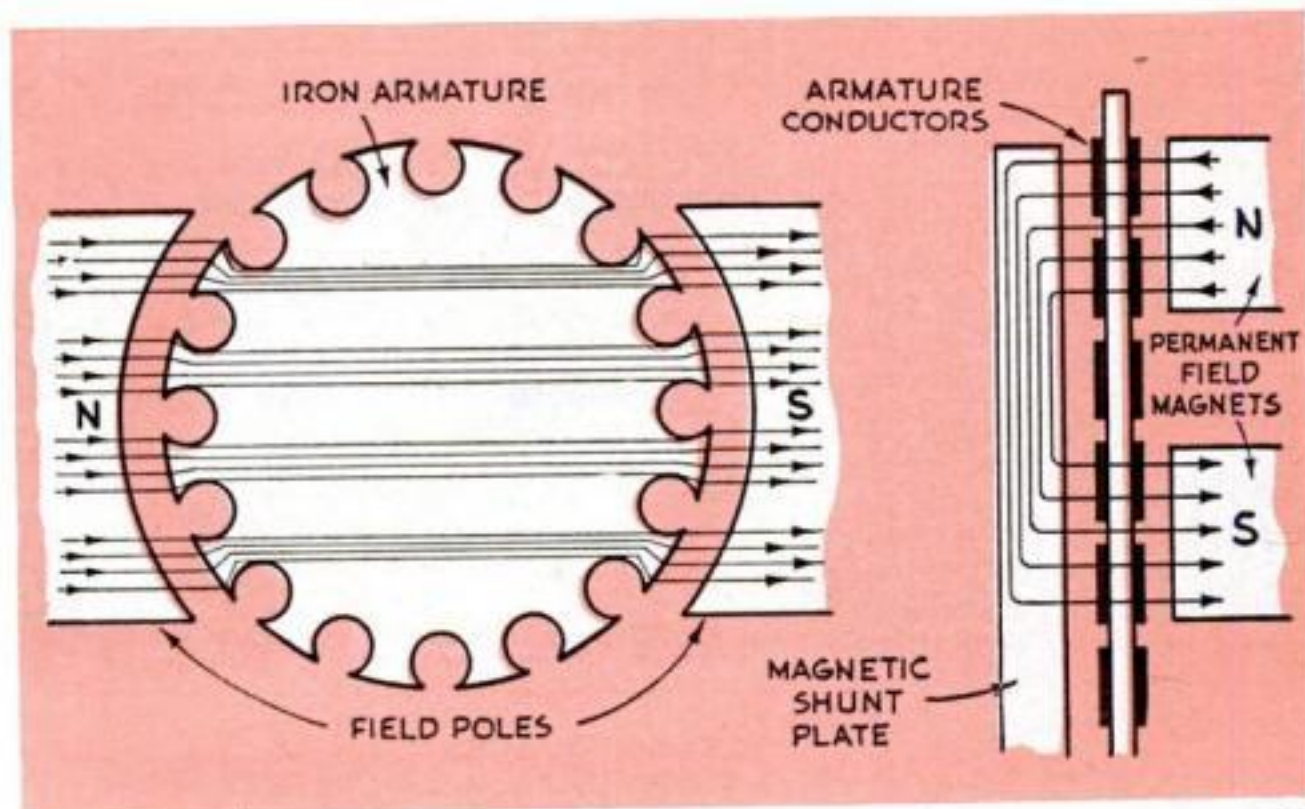


PRINTED ARMATURE at left is 3.6 inches in diameter, .030 inch thick (less than 1/32 inch), and weighs one-eighth as much as the conventional drum armature of the same output beside it. Brushes ride directly on the printed winding.

- Lower cost. Armatures are produced without hand assembly or soldering.
- Instant control. With no iron to act as a flywheel, the armature can start, stop, and reverse with literally electric agility.
- Big overload capacity. The bare conductors can carry fantastic currents for short periods.
- Clean commutation. The iron-less winding has no self induction, causes no sparking at brushes.

You needn't go to France for printed-circuit motors. Their components are engineered and manufactured by Photocircuits Corp., Glen Cove, N. Y., by arrangement with Printed Motors, Inc., holders of the U. S. patent applications.

But don't junk your home and shop motors just yet. So far, printed-circuit motors are for direct current only. And those wide conductors mean exactly what



CONTINUED

Big jobs await the new flat motors in servomechanisms for

you'd think: low-voltage, high-amperage machines. Small sizes could not be plugged into 115-volt lines.

You may soon see them, however, in new cars to drive wipers, work power windows and convertible tops, move power seats, and run heaters. The reason for Detroit's interest: low cost.

More exciting jobs await the new motors in servomechanisms for missiles, aircraft, submarines. In automated machinery, they can position work to split-second, hairline accuracy. Machine-actuating switches and coding wheels can be printed directly on the armature.

Coupled directly to the potentiometers that are the brains of analogue computers, the new motors can nudge them at up to 100 times a second. Printed armatures with special windings can be self-positioning or follow the commands of distant instruments or tapes. Combination machines may have more than one winding on a disk. One, for example, might run it as a DC motor while another generates AC, making a light and compact converter.

Lightning reflexes. Transistorized control circuits make the most of the instant response possible from these motors. A

typical small one can reach full speed from a dead stop in four milliseconds.

In Paris, I saw a punched-tape reader stuttering at a frantic rate. The tape was driven by a friction drum right on the motor shaft. A photocell reading through punch holes, with a power-transistor circuit, starts and stops the tape up to 80 times a second. With a sprocket on the shaft, you could transport movie film without cams, claws, or gears.

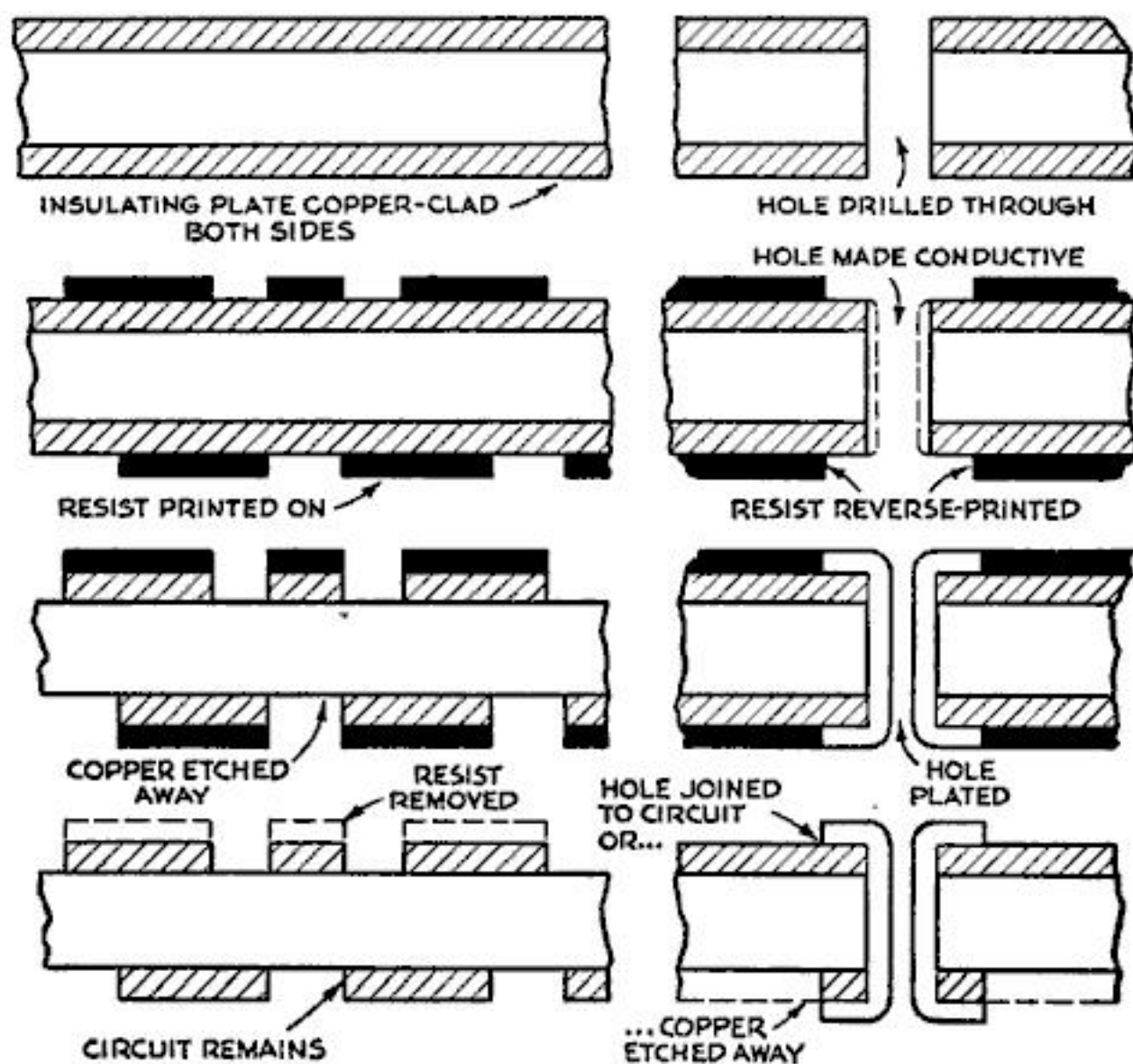
The inventors, J. Henry-Beaudot and F. H. Raymond, went back to basics in creating the new motor. Slight, bespectacled, English-speaking J. Henry-Beaudot traces it back to the classic Barlow wheel—a toothed disk that turned between the jaws of a magnet when current flowed from its shaft to its edge.

Put a movable conductor in a magnetic field, he points out, and shoot enough juice through it, and the conductor will move. The silicon-steel core in conventional armatures bridges the big air gap between the field poles, making a strong flux concentration possible. But the armature's own magnetic field is generated around the conductors. It exists even if you remove the iron.

Instead of being jacketed in insulation

Chemicals etch unprotected copper to leave circuit beneath

BASE MATERIAL is plastic or other insulating sheet clad with copper on both sides. On this is printed the design of the required circuit in a "resist," a coating that protects the metal under it from being etched away in a chemical bath. After unprotected parts have been etched, the resist is removed, leaving the copper circuit intact. Holes are plated through, joining the two sides. If the conductive hole is not to be electrically connected to adjoining circuitry, intervening copper is etched away by a chemical that attacks it, but does not affect the plating.



missiles, aircraft, submarines

and tucked into deep notches, the conductors of a printed armature are bare and whirl between two thin wafers of air, so radiating their heat to the field structure. They can stand 10 times the current density ordinary windings can—up to 100 amperes per square millimeter for short periods. Hence the great torque they can deliver.

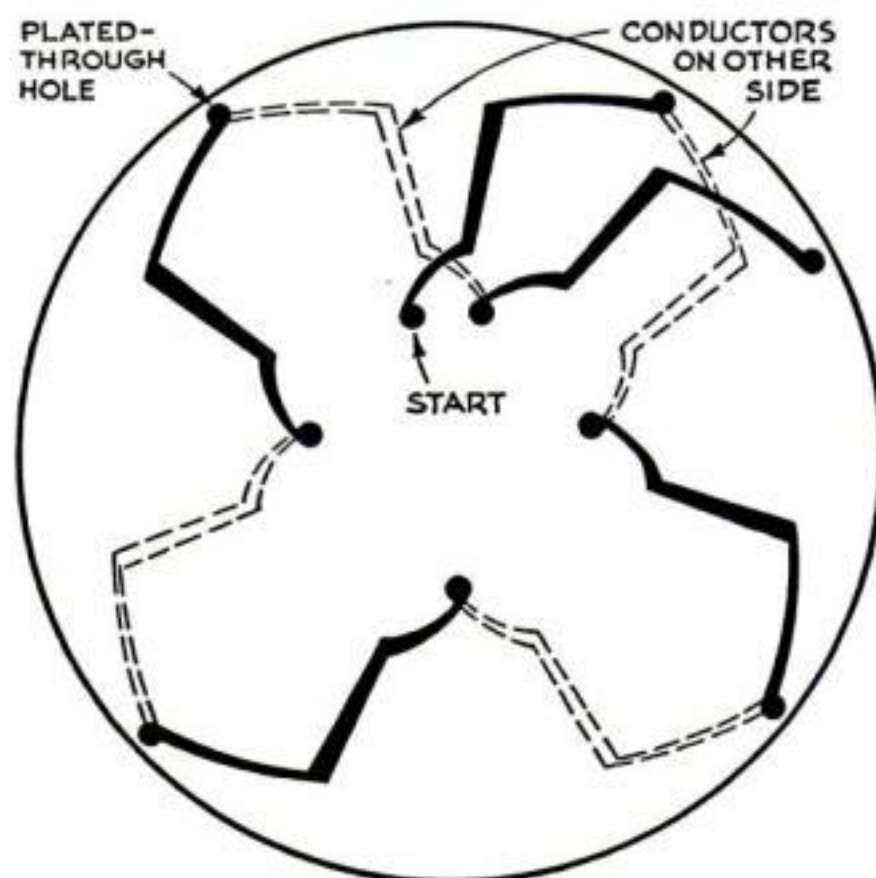
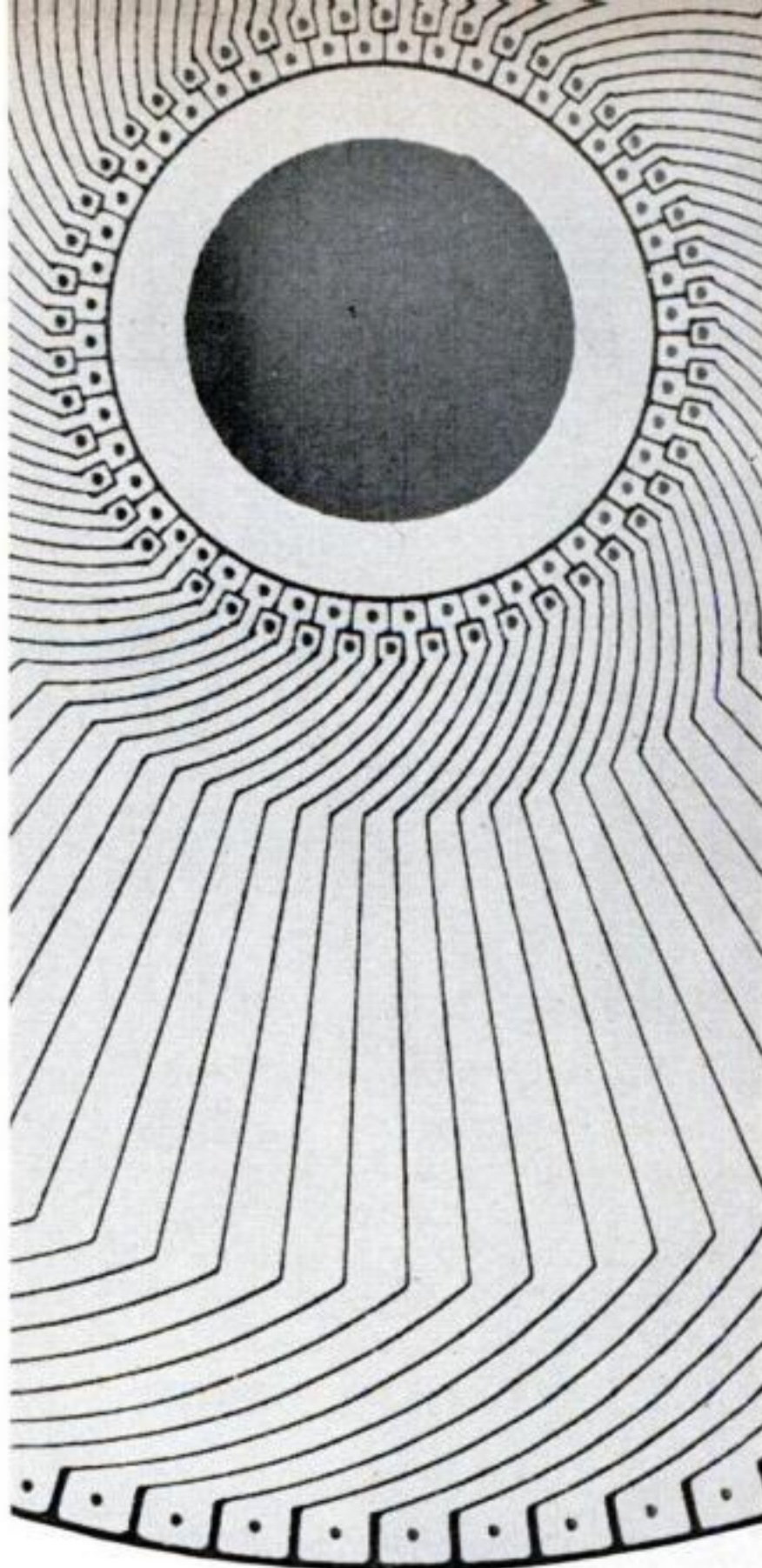
Windings can be printed on glass, ceramic, plastic, or metal disks (with thin insulation between, in the latter case). The newest disk material is Mylar, a synthetic that can be thinner and therefore more efficient. But for hair-trigger starts and stops, an aluminum disk is used. The instant power is cut, eddy currents brake the armature disk to a quick stop.

A typical armature of 3.6-inch size has 97 conductors, each serving as a commutator bar. Low-drop silver-graphite brushes ride on these. Because of the large number of commutator "bars" and the form of the winding—usually laid out to form four, six, or eight armature poles, the motor is free of "cogging"—a rough, steplike turning effort noticeable at low speeds.

Armatures as small as two inches in diameter have been made, but the smallest in mass production is the 3.6-inch size. Its cost in quantity is estimated at 50 cents. Since torque goes up as the 4.5 power of armature diameter, while cost mounts in direct proportion to area, big motors may be manufactured at bargain prices. A 10-hp. machine, it's estimated, might be built for less than \$150.

The printed windings are in effect a single turn with very low resistance—well below one ohm in most cases. Small motors operate at six volts; larger ones can be designed for up to 150 volts.

AC motors are feasible, but lots of research must be done before they hit the market. Meanwhile, the power wheel—a printed-circuit DC motor directly on the axle—is getting serious attention. With the fuel cell a reality (it's the gadget that generates electricity by burning butane or other fuel—PS, Feb.), we may be near a startling new kind of automobile. It would be silent, a cinch to drive, have no gearshift, transmission, drive shaft, floor hump, or tunnel—and might carry a smaller price tag.

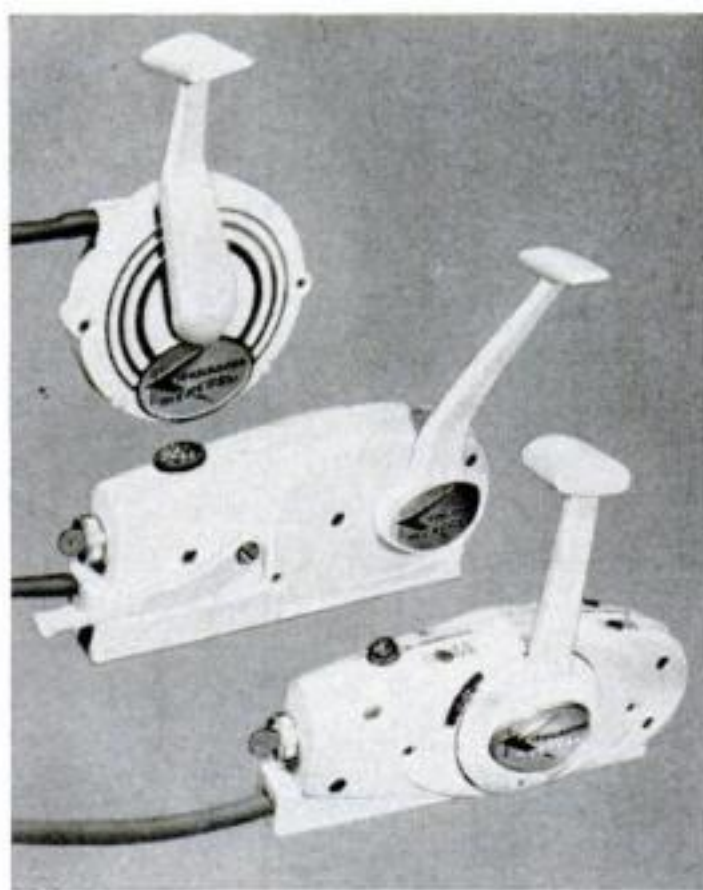


CLOSE-UP OF PRINTED WINDING. The holes at ends of conductor lines have metal in them, connecting to similar conductors on the other side of the disk. Wave-form winding is a single continuous turn, following a design that forms eight armature poles.

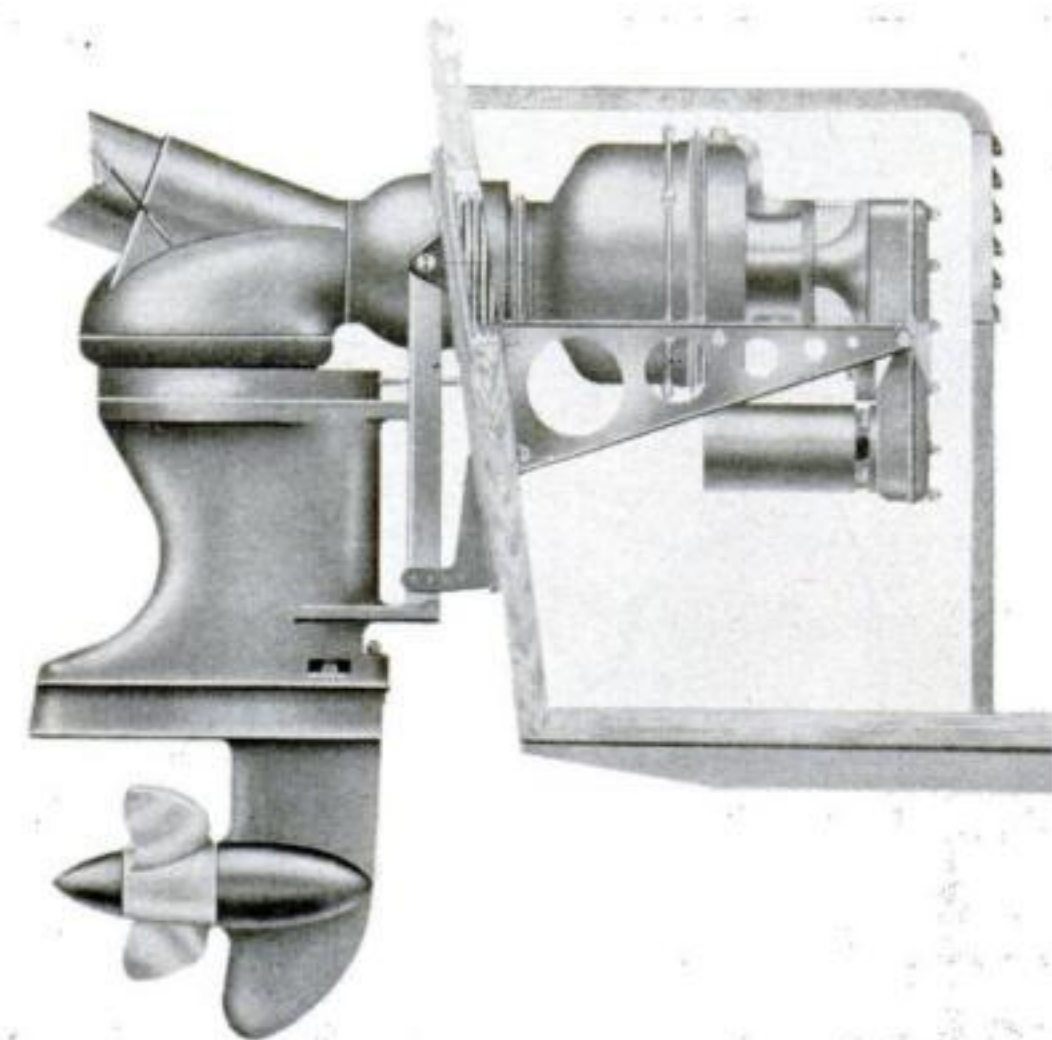
News from the 1960 Boat Shows



Outboard Raft Hits 35 M.P.H. Folded, this French boat of neoprene and nylon rides in the trunk. Inflated, 13- and 15-footers take a 35-hp. motor, 10-footer a 15. Sail kit is extra. Biggest Zodiac is \$1,150. N. Y. Rubber Corp., 100 Park Ave., NYC.



One Lever Operates Motor. New remote-control units change an outboard's speed and shift gears with a single handle instead of the usual pair. They're made for (from top to bottom) two-, four-, and six-cylinder 1960 Mercury outboard motors. Kiekhaefer Corp., Fond du Lac, Wis.



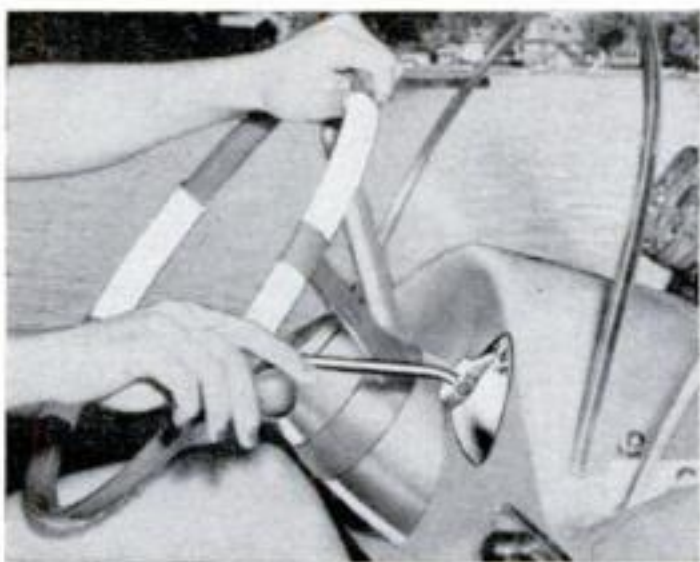
Turbinautic Drive. A gas turbine that burns gasoline, kerosene, or fuel oil powers this inboard-outboard. Made in sizes up to 250 hp., the units will produce one horsepower for every pound of weight. Precision Gears & Products, Inc., 132 Iowa Ave., Paterson, N. J.



Mockup Tests Skippers. On dry land, the Sailorometer scores a driver's handling of 10 marine emergencies, using real controls and sound color movies. Aetna Casualty & Surety Co., Hartford.



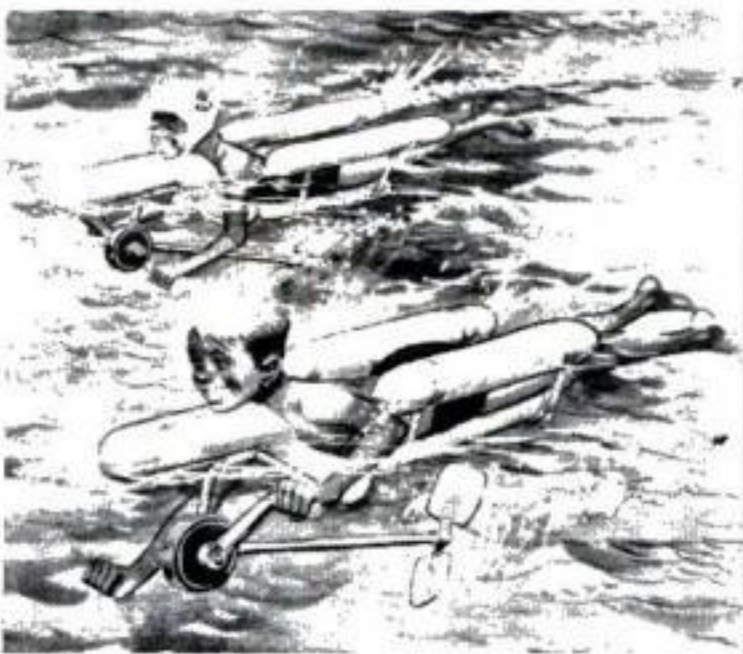
Tote Case for Outboard. Designed for portability, the new 7.5-hp. Scott fits into a canvas-and-leather carrying bag. The 30-inch-high motor weighs under 40 pounds. Case sells for \$19.95. McCulloch Corp., Minneapolis.



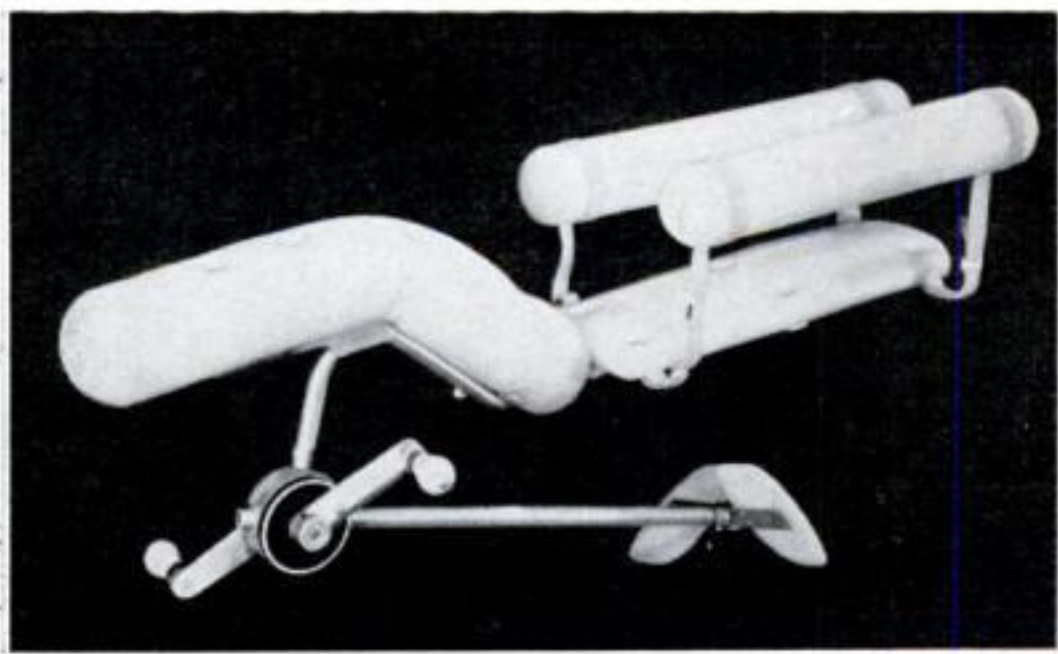
Dash-Mounted Gearshift. A remote shift for outboards goes on a runabout's dashboard. Patterned after the shift lever in an auto, the control has forward, neutral, and reverse positions. \$34.50. Tempo Products Co., Cleveland.



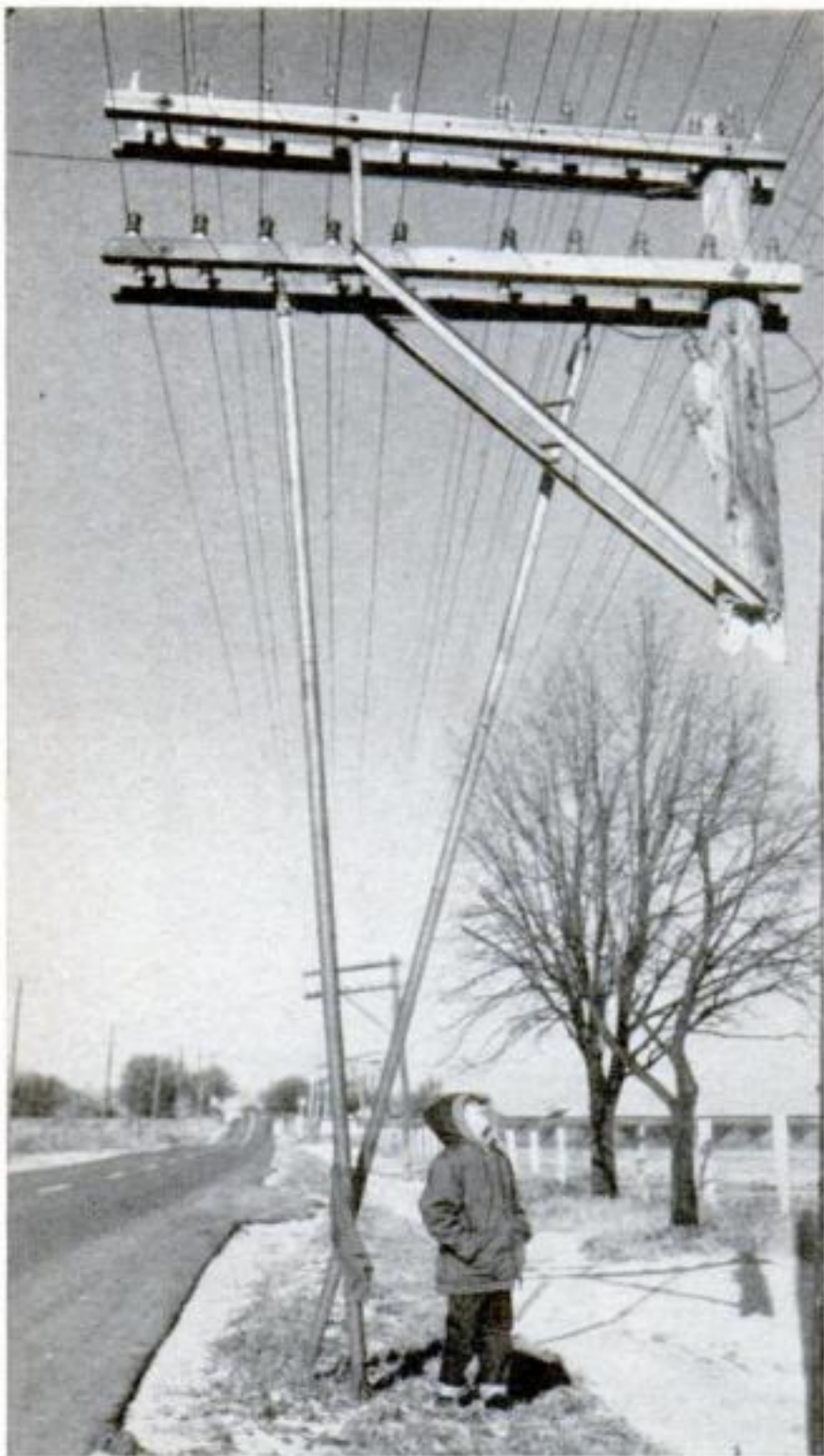
Collapsible Catamaran. In a half-hour, a 16-by-2-by-3-foot package unfolds to become a sailing catamaran. The craft requires no centerboard—its V-shaped hulls prevent sideslip. \$1,750 with sails. Waverider Corp., 250 W. 57 St., NYC.



Propeller Drives Float. Four pieces of plastic foam support the swimmer on a Water Jet while he propels himself by hand. Two cranks, through gearing, turn



a soft plastic prop to move the float forward or backward. Adjustable straps make the float usable by a six-footer. \$12.95. Argo Industries, Woodside, N. Y.



Floating phone pole

The crossarms of the telephone pole above aren't really flying. Repairmen at Fond du Lac, Wis., propped them up with pike poles until they could replace the pole broken by a skidding car.



Flying saucers

Not "proof" of flying saucers over the Municipal Airport at Akron, Ohio, but inadvertent trick photography that went unnoticed until the film was developed. The "saucers" are reflections of ceiling lights in a restaurant window.



Triple-deck flatcar

Three Thunderbirds, two Lincolns, two Falcons, and a Mercury station wagon rode to market in Los Angeles from Ford plants in Michigan on this 53½-foot flatcar. The Santa Fe Railway plans to add three decks to its long 88-footers. They'll carry 12 standard cars or 15 compacts, further surpassing the loads now hauled in boxcars or trailers riding piggyback.

Instant concrete pipe

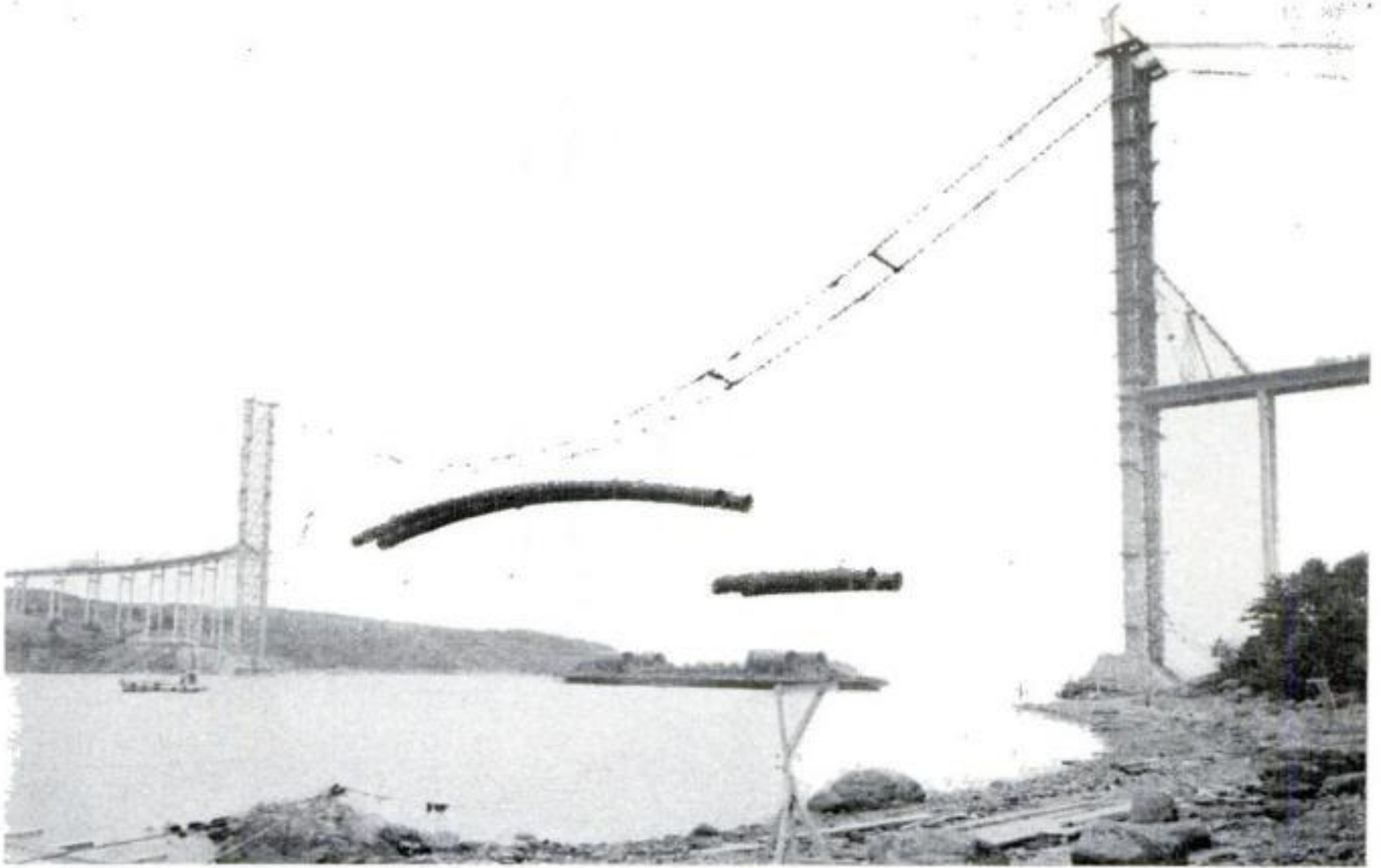
A machine that forms eight to 12 feet of concrete pipe a minute in freshly cut ditches is being used to lay irrigation lines on Arizona farms. It can put down storm sewers and other conduits as well.

The process, developed by Fullerform Continuous Pipe Corp., Phoenix, employs two 300-foot sections of inflated rubber-and-fabric tube as an inner form. Enveloping the tubing is an outer form built into a double pouring hopper and pulled along the bottom of the trench. Concrete is supplied from a continuous stream of ready-mix trucks.

By deflating and re-using one inner form after the other, a conduit can be laid for miles without a seam.



1. **BLOWN-UP TUBING** is first dropped into a ditch just cut by a trench digger.



LENGTHS OF PIPE are riveted together on the barge on the fjord below, then raised by steel

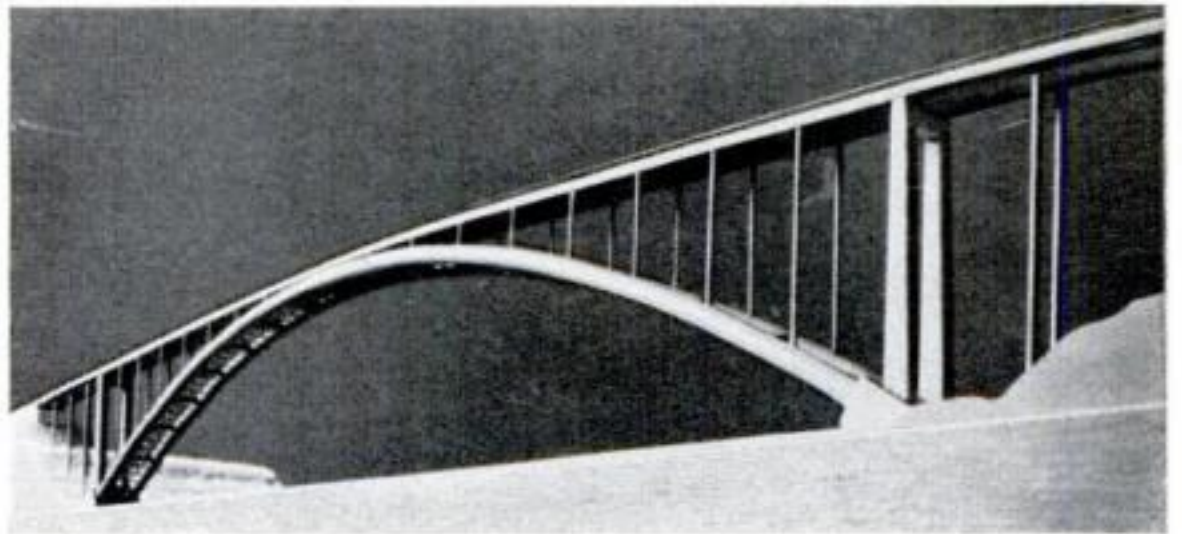
cables strung from pylons for final assembly in the air. The pylons are later dismantled.

Tubular bridge

A 920-foot tubular bridge has been built across the Fjord of Askero north of Göteborg, Sweden, to resist long, heavy winter storms.

The design was chosen when a model withstood a 100-m.p.h wind-tunnel test that wrecked truss bridges.

The approaches were put up first; then the span was built from the center out.



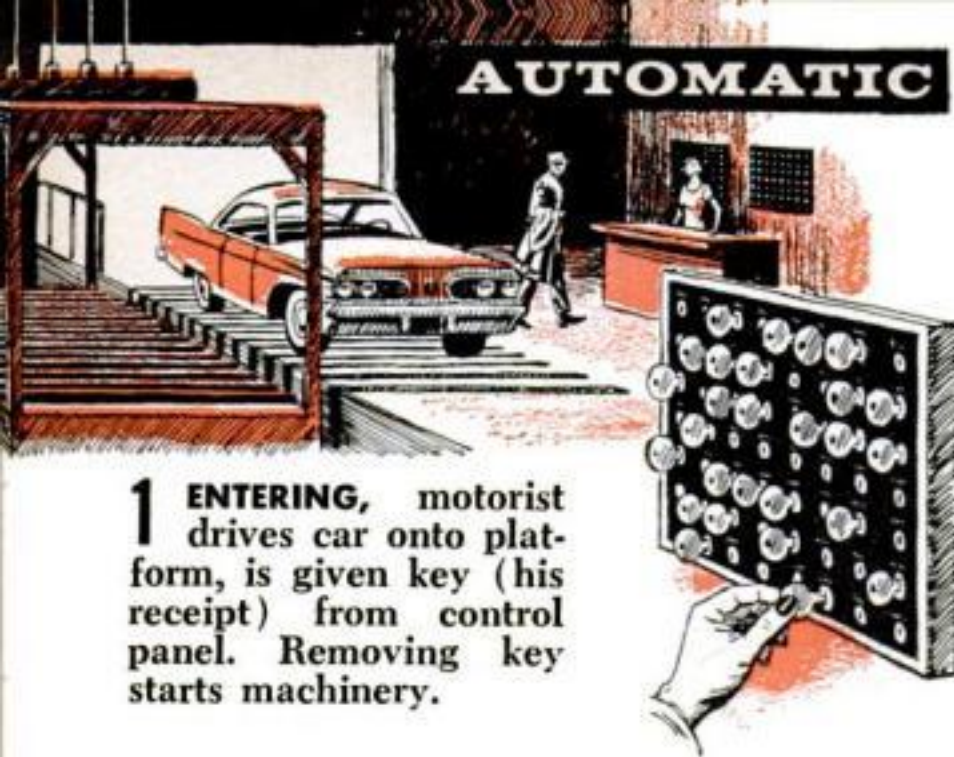
Artist's conception shows what bridge will be like when done.



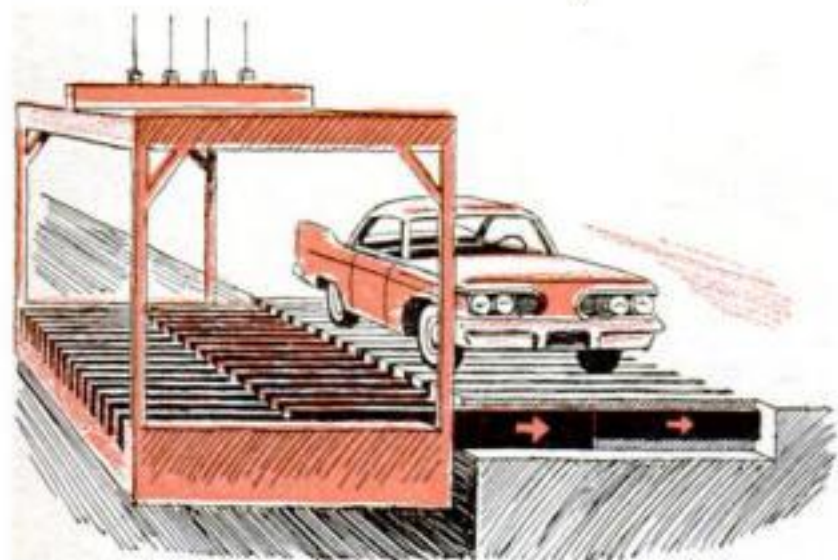
2. POURING MACHINE carries out form with it. Line of ready-mix trucks keeps it filled.



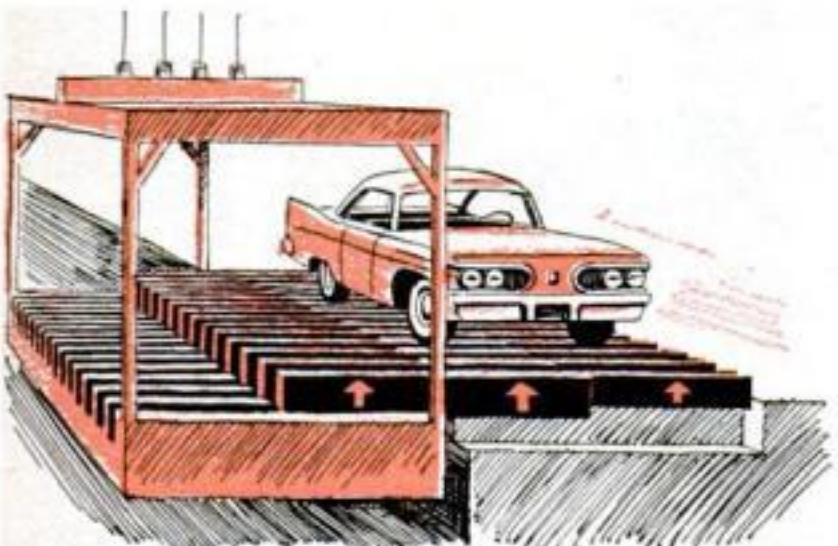
3. FINISHING OFF PIPE, a smoother works from the back of a platform on the mobile pourer.



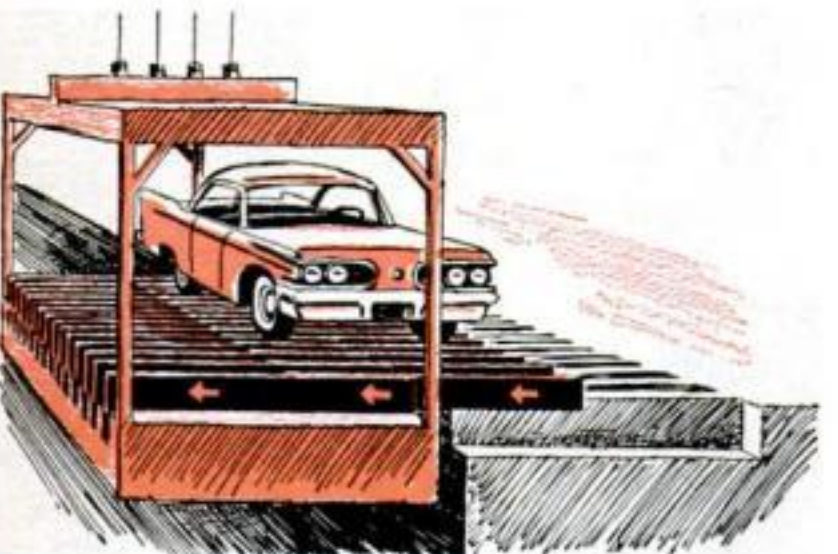
1 ENTERING, motorist drives car onto platform, is given key (his receipt) from control panel. Removing key starts machinery.



2 TWO-SECTION CONVEYOR GRID in elevator is activated when key is removed. Opening, it slides between platform grids.



3 RISING at end of sideward movement, conveyor lifts car up off its platform.



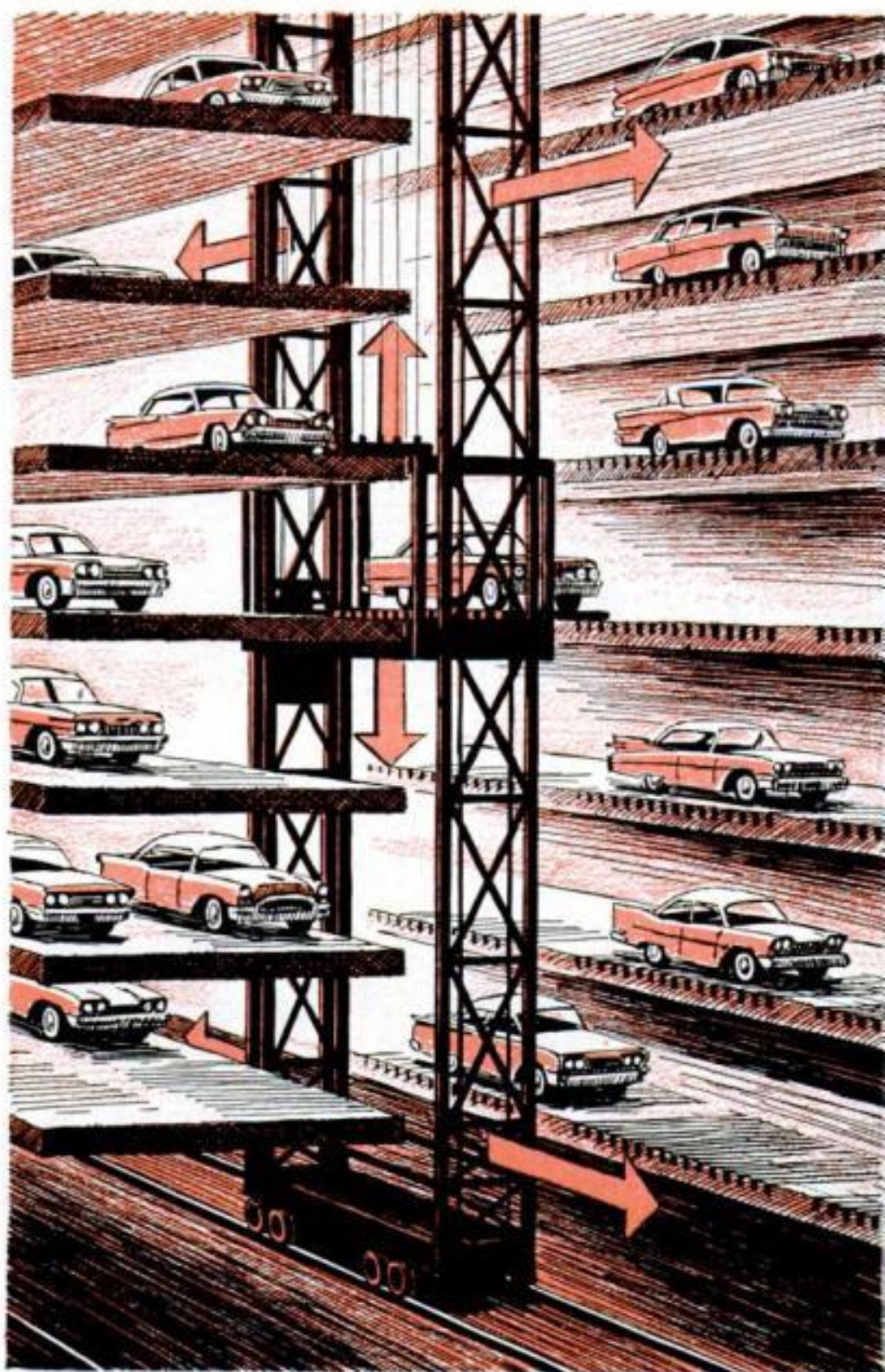
4 SLIDING BACK, conveyor takes car into elevator. Elevator will then rise—as its wheeled tower rolls sideward—to stall predetermined by location of key in panel.

On the Way:

Parking problems? These devices swing and stack your car to get it out of your hair

MECHANIZED parking is the engineer's answer to the American motorist whom neither rain, nor snow, nor paralysis of traffic can stay from driving into the city.

Strange and ingenious contraptions have appeared: lift-'em-and-stack-'em systems, big as a building, that pigeonhole cars neatly on steel shelves; hydraulic



5 DISCHARGING, conveyor sets car down on grids in stall. Insertion of key later, when motorist returns, reverses process, delivering car to entry. This is Speed-Park (NYC) system.

Pushbutton Parking

SEMI-AUTOMATIC



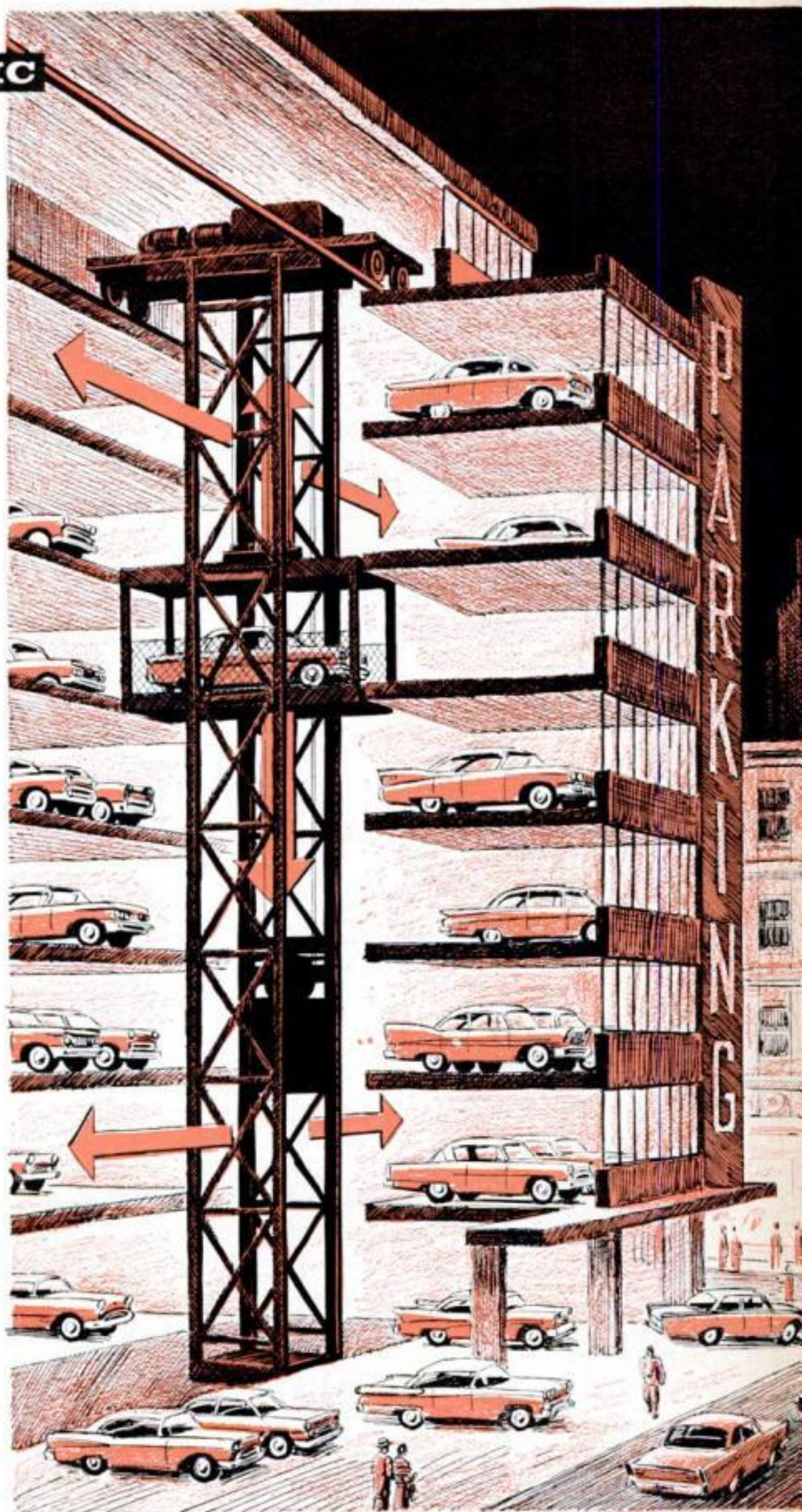
1 ENTERING, motorist gets receipt for his car from attendant. Receipt stub is then placed in a pneumatic tube, which shoots it ahead to a girl at the control panel.



2 AT CONTROL PANEL, stub is inserted in an empty slot (there's a slot for each car stall). This lights a signal in the elevator, showing attendant where the car is to go.



3 DRIVING CAR into elevator, attendant punches a button next to the signal light. This closes the safety gates and sets the elevator machinery into motion. System is made by Bowser, Des Moines, Iowa.



4 SUSPENDED ON RAILS, elevator tower rolls toward designated stall as elevator rises. Attendant then drives car off. When motorist returns, his receipt is checked against stubs on control panel to locate car, and the process is reversed.

CONTINUED



HYDRAULIC PLATFORMS, like the grease racks in a service station, rise to permit two-level parking in this open-air lot. The devices are made by Simmons Industries, Albany, N.Y.

GIANT WHEEL provides car-size cradles slung on endless chains, needs no attendants. Punching button brings empty stall to drive-in level. Made by Auto Park Towers, Jackson, Miss.

jacks that elevate a car so that another can nestle underneath; a Ferris wheel that keeps a Christmas-treeful of cars circling in air; a tilter that stands a car almost on its nose so that it takes up only half as much costly ground space.

The whopping, building-size parking machines aren't limited to public garages. A tenant in Oklahoma City's new Petroleum Club office building can steer his car onto an elevator, push a numbered button on the control panel outside the driver's window, and be whisked up and across the building until the elevator stops in front of his parking stall—just a few quick steps from his office. Similar "room-side" parking is available in Mexico City's new Astro Hotel. The First National Bank Garage, also in Oklahoma City, combines drive-in banking, an auditorium, shops, a restaurant—and automatic parking facilities on 12 floors.

Mechanical parking systems are being installed in major cities all over the country. They range in complexity and cost from the fully automatic Speed-Park system illustrated, through semi-automatic systems like Bowser's, also illustrated, to the simpler devices shown on this page.

Is pushbutton parking the answer to our parking headache? Some experts say no. At best, a one-elevator system can handle only about 60 cars per hour. A five-elevator system can handle 300 cars.

But a well-designed ramp-type garage can manage about 800 cars an hour and, with the motorist parking and unparking his own car, requires few attendants.

To the average car owner, however, the pushbutton garage, which can be incorporated into his office building, his hotel, or his apartment house, may seem like a fine answer to the question: "Well, where do we park?"



TILTED RACKS have caster wheels. After car has driven on, rack is tilted hydraulically, then

rolled by attendant into position. All American Engineering, Wilmington, Del., makes it.

8-mm. Camera Takes Talkies



Magnetic stripe outside sprocket holes carries sound. Film is run through twice and split.

A NEW camera and projector outfit for under \$500 has broken the sound barrier in home movies. At a cost of about \$2.25 per minute, covering film and developing, an amateur can record voices and background sound at the time he takes his pictures. He can add music and narration or erase and re-record later, on the projector.

The Fairchild camera has a three-lens turret with a 13-mm. f/1.8 fixed-focus lens for normal use. A telephoto lens, wide-angle lens, and exposure meter can be added. Inside the camera, a motor transports the film at 24 frames per second. The built-in four-stage amplifier uses transistors and a printed circuit. The motor and amplifier are powered by a sealed nickel-cadmium battery. Using a cord provided, the battery is recharged on house current after every eight rolls.

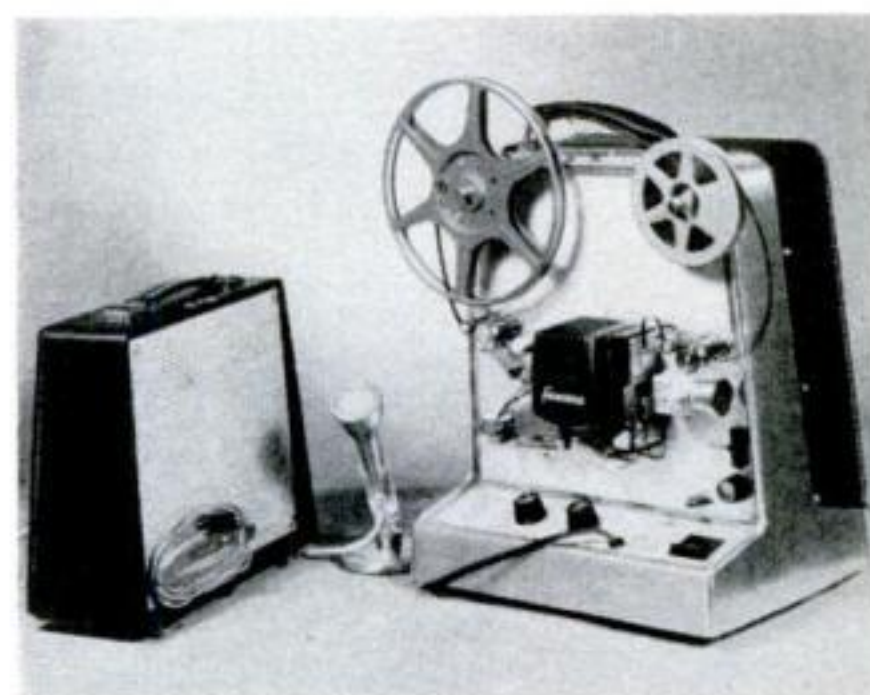
The special Ansco color film (ASA 12, Tungsten) comes with a magnetic stripe only .025 inch wide on each edge. Run through the camera twice, a 50-foot roll is split to make a 100-foot reel. A roll costs \$7.50, developing about \$2.50. Black and white will come later.

The projector records and plays back at 16 or 24 f.p.s. Thus, silent films shot at 16 f.p.s. can be striped to add sound with this projector. A ceramic microphone, six-inch speaker, 400-foot reel, and 150-watt lamp are included.

The camera lists for \$239.95, the projector for \$249.95. They're made by the Fairchild Camera & Instrument Corp., Yonkers, N. Y.



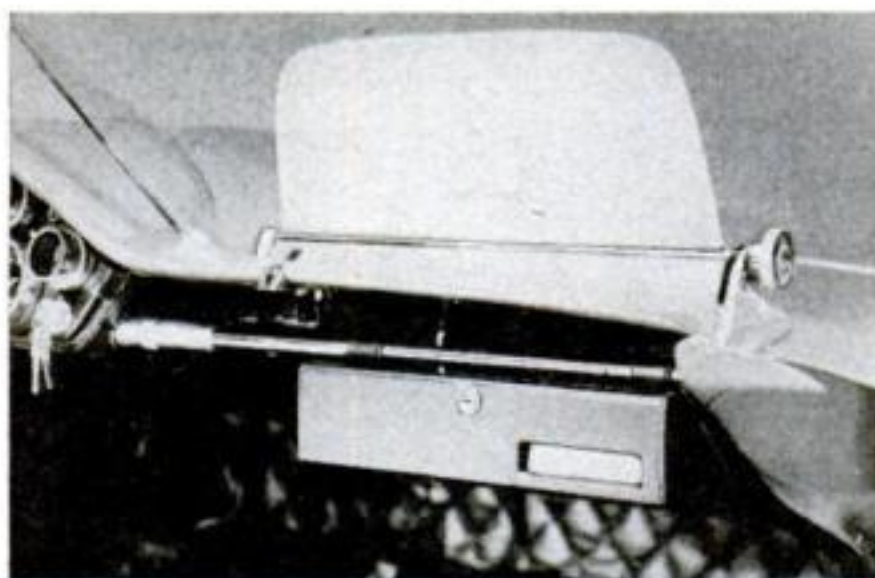
CAMERA RECORDS SOUND through a microphone with a 15-foot cord. The sound level, varied by a control on the back of the camera, is monitored by headset. Weight with battery—4½ pounds.



SOUND PROJECTOR runs at 16 or 24 frames per second (silent and sound speeds). A switch lets you play back, overlay new sound on the original recording, or erase and start fresh.



SEAT FOR PASSENGER is four inches lower than driver's so he won't create wind resistance.



GLOVE BOX, below passenger windshield, pulls out to become shoulder-strap carrying case.

Idea Car Is Built Off-Center

The off-balance-to-the-left look of the new Plymouth "idea" car is said to be functional. The raised front air scoop and the high, flaring rear stabilizer are in line with the driver. Otherwise his head and shoulders would stick up into the wind and interfere with the streamlining.

The lean, waist-high sports car is named the XNR after its designer, Virgil M. Exner, a Chrysler Corp. vice-president. About his creation he says:

"We believe that an object's design should describe its function. The really modern automobile should be poised for action."

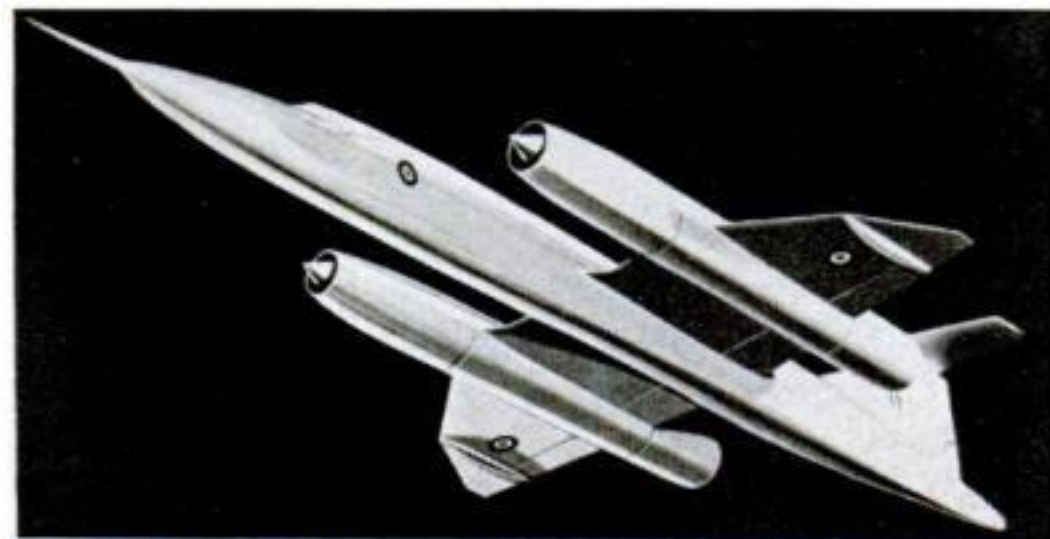
Said a fellow vice-president, gazing at the Plymouth of the future: "I've never seen anything like it."

Studio-designed here, the XNR chassis and its standard six-cylinder engine were shipped to Turin, Italy, where the body was handmade by Ghia.

The gas cap on the rear deck is of the Grand Prix type.



Rear bumper is in the form of an off-center cross. Tires have one-inch side-wall stripes.



Supersonic plane made of stainless steel

Here's how an artist sees the supersonic Bristol 188 scheduled for flying tests this year for the British Ministry of Aviation.

Its two de Havilland turbojets are fitted with a reheat system to boost thrust and attain speeds of better than 1,500 m.p.h. It has a stainless-steel fuselage to resist air-friction heat.

The War Between Burglars and Inventors



A growing arsenal of ultrasonic waves, light beams, TV, and vibration detectors is making burglary a difficult profession

By Robert Gorman

THINGS are getting to the point where many an old-hand burglar or safecracker may have to learn a new trade. More and more of the goodies worth stealing are now being protected by sound

waves a cracksman can't hear, by light beams he can't see, by barriers he can't feel.

The very act of forcing a door or window is likely to give him away. The same thing happens if he tries to hole through a wall. Even if he manages to evade intrusion

CONTINUED

Electronic screens hold off burglars by reinforcing walls,

alarms by hiding out inside a shop until after closing time, he runs up against sneaky electronic detectors that will bring the gendarmes at a gallop.

The protection systems a burglar faces nowadays are increasingly tricky. Alarms are often silent—instead of clanging overhead, they ring a bell at a private guard station not far away. Sometimes a dummy alarm box is placed prominently over a door. By remaining silent during a break-in, it contributes to a thief's innocent sense of security, encouraging him to labor away while the cops close in.

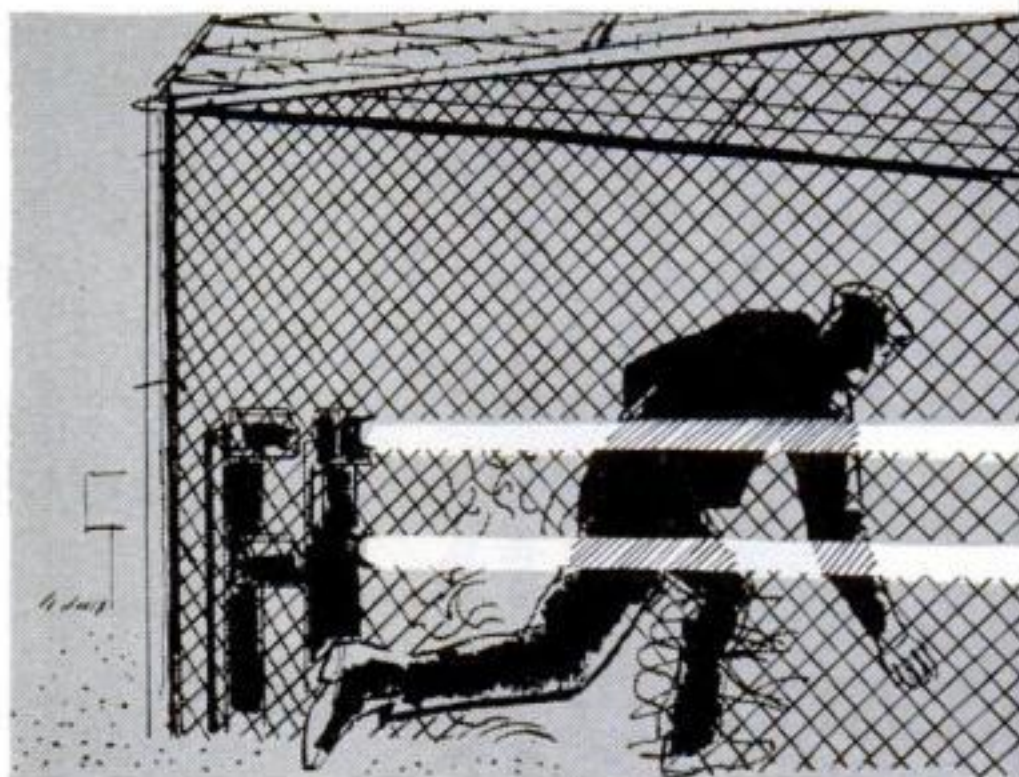
Tricks of the trade. Silent signals also make possible defenses in depth that add insult to frustration. Doors and windows are often "barred" by flimsy grids of $\frac{3}{8}$ -inch dowels painted to look like metal. A child could easily rip them away with one hand—but not without breaking one or more alarm wires laced through the wood. Or a cracksman may find an office safe enclosed in a decorative wooden cabinet. It's simple to open the cabinet, and certain to bring the cops.

Backstopping one protective device with another, however, underlines the fact that almost any system may be defeated by a burglar with skill and luck.

In this light, how good are modern protection systems? One answer is in dollars-and-cents: For approved installations, insurance companies allow discounts of up to 70 percent on burglary insurance. Experienced burglars naturally tend to steer clear of protected premises. The emblem of a good protection agency on a shop door is said to cut burglary attempts by 50 percent. (As a result, there's a thriving black-market business in emblems to be used simply for display.)

The granddaddy of all electric protection—and still an essential part—is the entrance switch. This is in effect a refrigerator-light switch. In one of its earliest forms, pairs of springy contact strips, mounted on shop doors and windows, were normally held apart by nonconducting studs. Forced entry would allow them to touch and close a bell circuit. This worked fine as long as burglars didn't know it was there. Nowadays, of course, any hep kid could defeat such a primitive bell circuit in a dozen ways.

For many years the most popular way



INVISIBLE-LIGHT BEAMS spot intruders indoors or out. The beams can range to 300 feet or more, may be bent or broadened with mirrors.



FOIL OR WIRE LACING secures a building's walls, doors, windows, floors, and ceilings. It is used to supplement door and window alarms.

was to cut a wire. No circuit, no alarm. It's not so simple now, with current flowing through the circuit at all times. The alarm, separately powered, is set off by any significant change in current flow. Cutting a wire is one way of producing this change. Power failure has the same effect, so it does no good to disable outside cables.

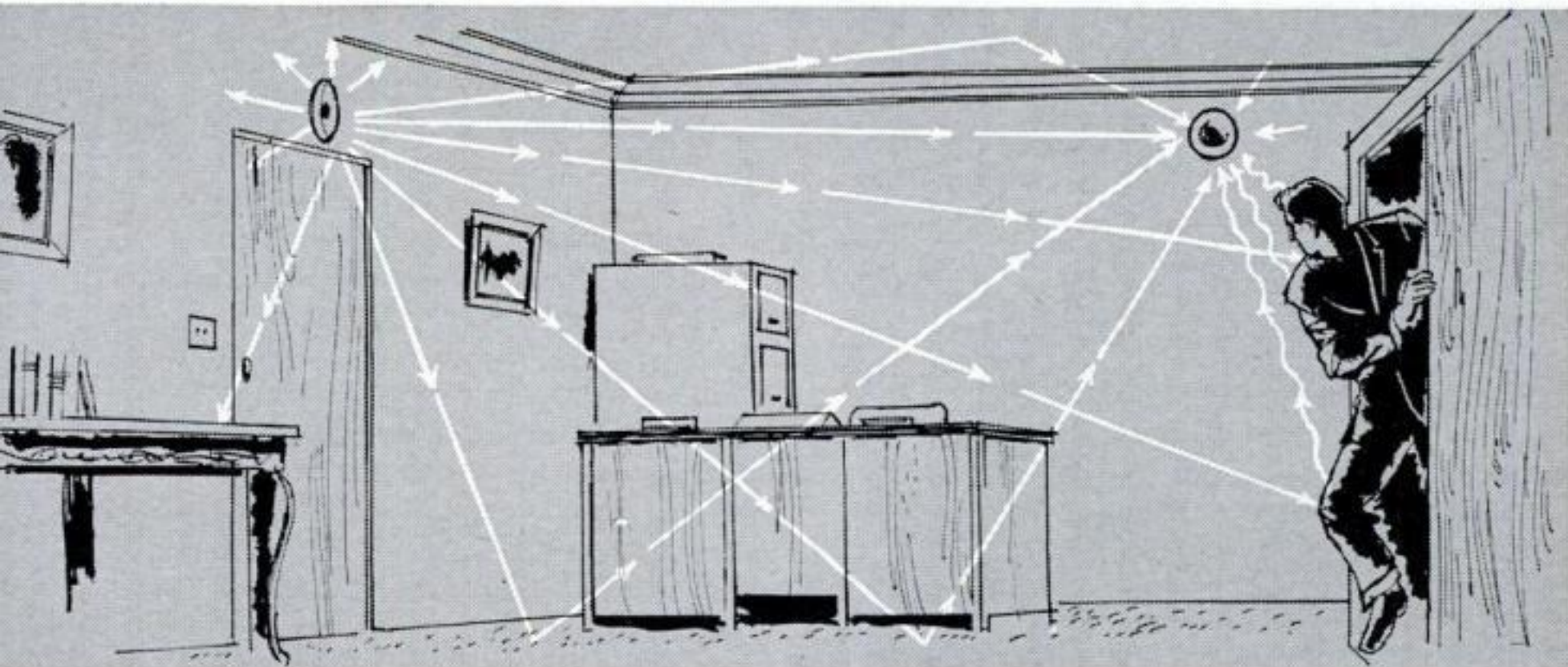
Early methods. Closed circuits over direct or leased telegraph wires were introduced early in the burglar-protection business. They tidied up a major weakness of earlier window switches. Burglars had

fences and gateways

CAPACITY FENCE (right) safeguards an exposed perimeter. Electronically balanced wires can detect a person within three feet, and are proof against fence climbers. Sloped wires offer one-sided protection. Fence may also be grounded to shield the street side.



PLASTIC SHEETING under capacity fence keeps down weeds that could cause false alarms. Free-standing type would be used in restricted areas to detect approach from either side.



RADAR-LIKE DETECTORS saturate an enclosed area with sound or radio waves. An intruder gives an alarm by changing the reflective path

—and frequency—of the waves. Reflected waves are also used in beam-type systems similar to invisible-light straight-line barriers.

already caught on to an obvious truth: A window can be entered by cutting or smashing the glass, as well as by prying up the sash. This loophole was closed by bordering windows with strips of metal foil. Any crack in the glass that spread out toward an edge would part the foil.

The change from open- to closed-circuit alarms naturally required changes in switches. Contacts had to be reversed so they would be opened, not closed, by forced entry. Some smart crooks turned this to advantage. By drilling through glass or sash, they could reach and bridge

the switch terminals, and then force entry.

Magnet vs. magnet. This threat was partly answered by placing wiring out of reach, and partly by use of magnetic contacts. An enclosed relay on a doorjamb, held open by a permanent magnet on the door, makes an entry switch practically immune to electrical tampering. But then shrewd burglars discovered they could defeat some magnetic catches by prying a little space between jamb and door and slipping in a slim magnet. This substitute would hold the relay while the door was opened.



TV—OR FILM—CAMERAS are often hooked into intrusion-alarm systems. TV gives an instant report to a plant monitor; film's permanent record is useful for identification and evidence.



CENTRALIZED control and reporting stations in many large plants allow one guard to supervise security at remote points. Signals from any type of detector can be fed to one console.

If an aspiring cracksman happens to read this, he's welcome to the information. Modern door switches—both electric and magnetic—make a sequence of opening, closing, and grounding contacts. To outsmart them, a burglar not only has to short out the terminals but must also duplicate the order and timing.

Screens of wired dowels have been made similarly confusing. In their earlier form they could be mastered by a patient burglar who shaved away covering wood and bridged the current-carrying wires at their entry points. These days screens incorporate several independent circuits

and give an alarm if any wrong pair is shorted as well as if any single wire is broken. Conceivably an electronically sophisticated burglar might work out the right combination if he could 1) expose all the wires without breaking one, and then 2) carefully test continuity with a high-resistance voltmeter. A task like that could make honest labor seem attractive—especially since wired dowels are, usually, only a first line of defense.

Detectors everywhere. Faced with such obstacles, many thieves have found it more judicious to pickaxe a wall than to tamper with doors or windows. But complete electric protection now includes wire lacing in walls, floors, and ceilings. Detectors sensitive to vibration are also used to spot sawing or hammering.

With breaking and entering becoming increasingly profitless, enterprising thieves often plan to hide out in a store until after closing time, collect loot in a leisurely fashion, and then smash out. Although the last operation gives an alarm, an escaping thief can usually beat out even the fastest guard response.

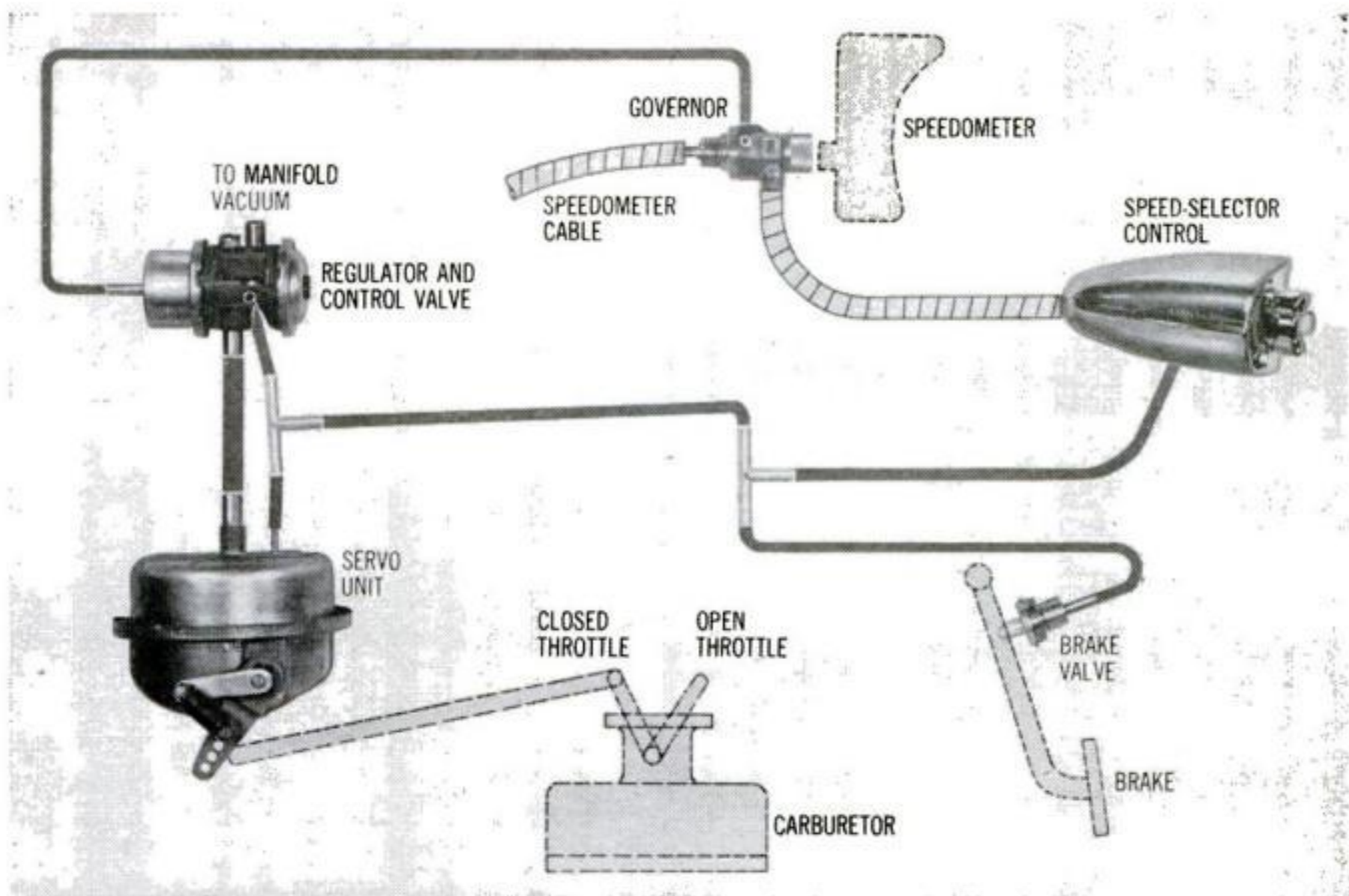
This kind of after-hours shopping is becoming more and more difficult because of a growing assortment of hide-out detectors. "Floor traps" were among the first. Originally these were switch boxes placed at intervals along the walls, a foot or so off the ground. A storekeeper would string twine from each box to a hook on the opposite wall, dividing the floor into a network of rectangles. As a burglar moved around—usually in the dark—he would be apt to pull at least one string.

Smarter thieves soon learned to tie back the switches. So twine gave way to current-carrying wires. Plugs at opposite ends of each wire are fitted, not too tightly, into switch jacks on the walls. An alarm results if a plug is pulled or a wire cut.

Scientific traps. Though floor traps have proved highly effective, it's a chore to set them up at night. And—in theory, at least—they can be avoided by nimble-footed burglars. So newer devices that go into action at the flick of a switch have been brought along. They rope off areas with light, sound, or radio waves.

Most of them consist of matched pairs of transmitters and receivers. Like a doctor listening to his own heartbeat, the re-

[Continued on page 220]



Production speed controllers may vary in detail, but will closely resemble this prototype.

Coming: A \$50 Speed Control

AN AUTOMATED accelerator at reduced price is what you might get with a new speed-control system developed by GM's AC Spark Plug Division to retail for under \$50.

Like Chrysler's and Cadillac's existing and more expensive automatic speed-control systems, ACon-O-Cruise permits foot-off-the-throttle driving at constant speeds on turnpikes and open highways. In town, it is a "ticket-saver"—warning a driver when he reaches a preset speed by building up accelerator back pressure.

ACon-O-Cruise operates on manifold vacuum alone, with no electric motor. It has just five major parts:

- Speed-selector dial, with a lever you can set either for speed warning or automatic cruise control.
- Governor on the speedometer drive. It controls an air valve that "reads" road speed.
- Pressure valve, which regulates engine vacuum to control car speed.



- Servo unit; this controls the carburetor throttle.

- Brake-pedal release valve, which cuts out the unit with the slightest touch on the brake.

For constant-speed driving you flip the lever to the automatic-cruise-control position, then set the dial for the speed at which you want to travel. When that speed is reached, you can take your foot off the accelerator. The car bowls along at the selected speed until you touch the brake or move the lever to the speed-warning position. Speed varies less than two m.p.h. on hills.

ACon-O-Cruise is designed as an original-equipment option, not an after-market accessory that could be added to his car by an owner. "Could be done, but it wouldn't be too practical," say AC engineers. Several auto companies are studying the device, although none has bought it yet. AC reports it could tool ACon-O-Cruise for production "within six months."—Ken Fermoye.

America's Most Misunderstood Snake

By Wesley S. Griswold



The harmless but alarming gopher snake has a tough time—he's forever being mistaken for his deadly look-alike, the rattler

ONE day last spring, a young farmer in Santa Cruz, Cal., got the scare of his life.

He had just put his tractor in gear to begin plowing a field, when suddenly a big brown-and-tan snake slid out from under the seat and poured down over his feet.

With a wild yell, the farmer jumped to the ground and ran toward his barn. The tractor wobbled forward a few yards, then swerved into a shallow ditch and stalled.

A farmhand who had heard the shout and seen the antics hurried to meet his white-faced boss.

"There's a damn rattler on the tractor," the farmer said huskily.

His helper picked up a rock and strode toward the abandoned vehicle. The farmer cautiously followed.

When they got there, the snake was still aboard, coiled on the floor, and looking mean. It greeted them with a ferocious hiss. The tip of its tail was a blur. The farmhand, with a tense expression, carefully aimed the rock. Then, abruptly relaxing, he began to laugh.

"This ain't no rattler," he said. "This here's a good snake—a gopher. He won't hurt ya none."

Carefully grabbing the snake just behind its head, he pulled its six-foot body

to full length and threw it into the grass. The snake crawled casually back to its job of killing crop-destroying rodents.

You could hardly blame the farmer for not recognizing one of his best animal friends. People are forever mistaking the blustery but benign gopher snake for the malignant rattlesnake.

It's an easy mistake to make. For though the gopher snake huffs and puffs and often whirs upon meeting a human being, simply in nervous apprehension, it almost never strikes at one. And its bite is harmless. All it asks of life is a steady diet of rats, mice, gophers, moles, and ground squirrels. These rodents have been estimated to do more than \$400,000,000 worth of damage each year to the U. S. grain crop alone.

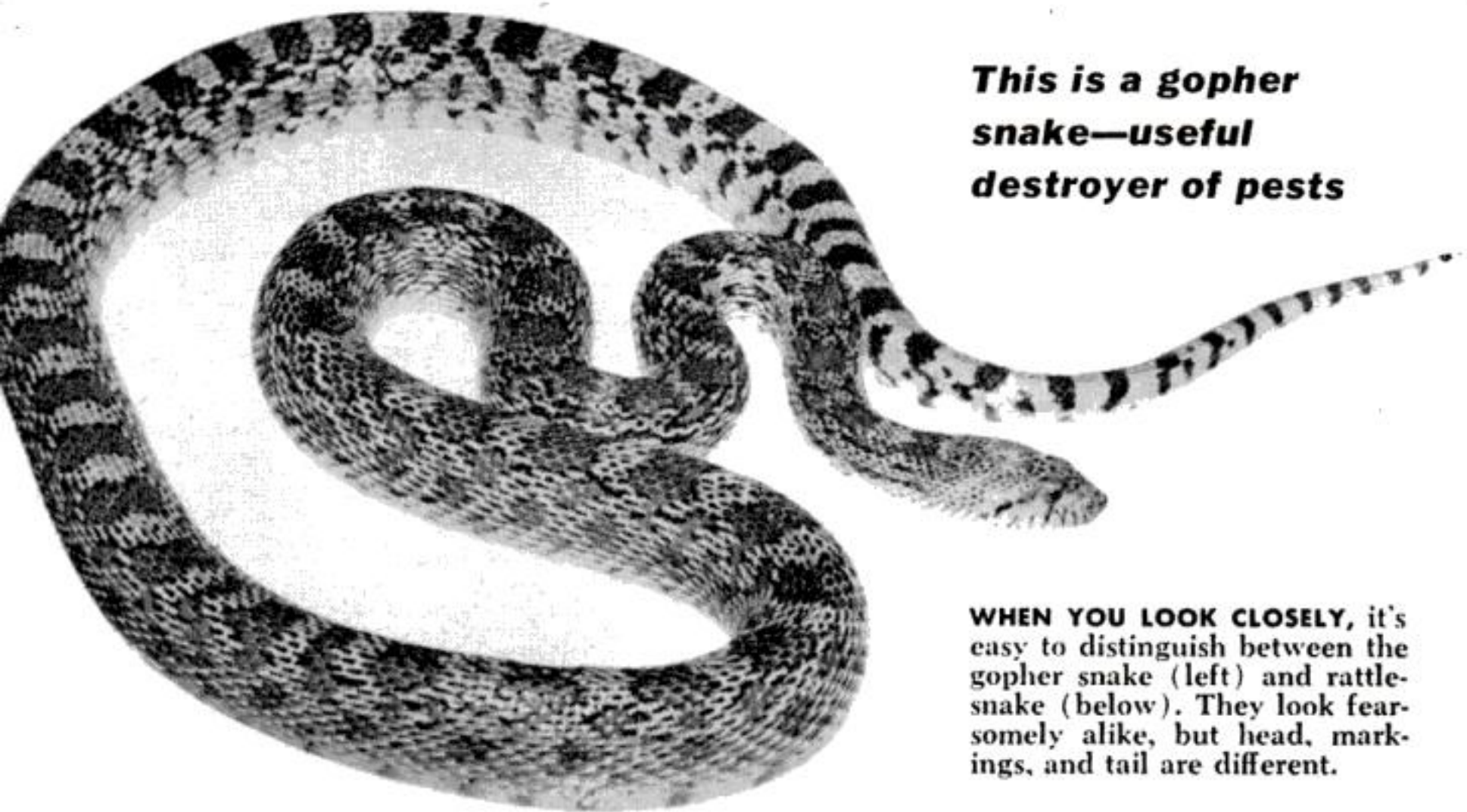
The two snakes, gopher and rattler, are similar in color and length. Both react menacingly to a person's approach. They coil their long bodies and rapidly shake the tips of their tails. The gopher snake has no rattles, but this is often overlooked in the excitement of encountering one. If its vibrating tail happens to be

beating against dry weeds or leaves, the noise it makes is a fearsome imitation of whirring rattles. And the gopher's violent hiss, which it pro-



MORE OF A MENACE:

The appealing ground squirrel is a constant threat to both growing and stored crops. Gopher snakes, when not killed off, help to curtail its ravages.

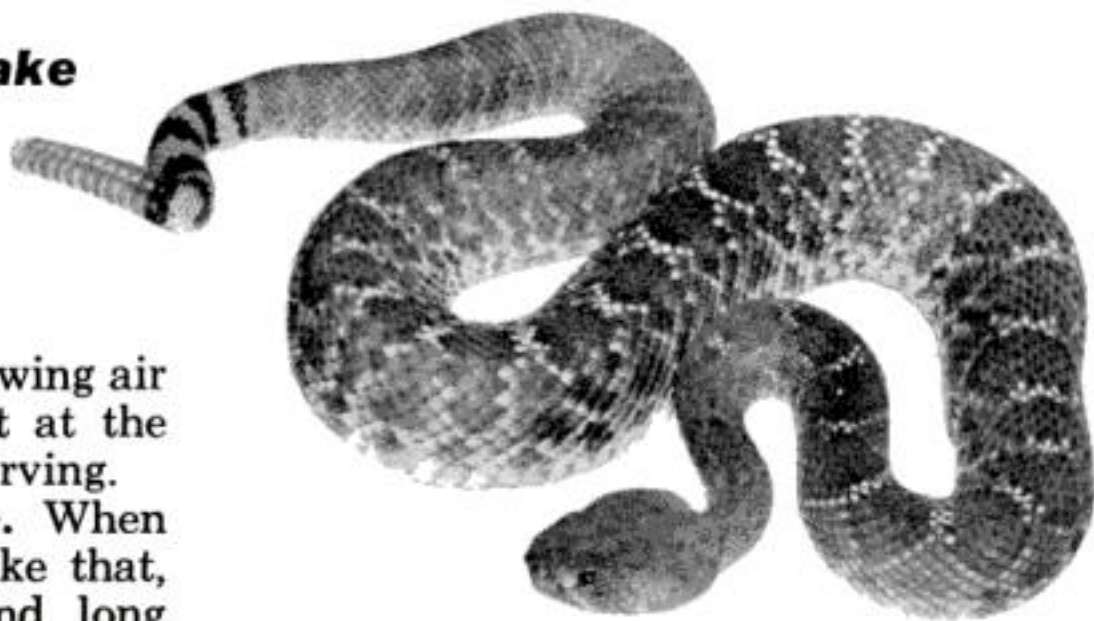


**This is a gopher
snake—useful
destroyer of pests**

WHEN YOU LOOK CLOSELY, it's easy to distinguish between the gopher snake (left) and rattlesnake (below). They look fearfully alike, but head, markings, and tail are different.

... This is a real rattlesnake

RED DIAMOND RATTLER—a member of the venomous pit viper family—is one of 30 kinds of rattlesnakes found in U.S.



duces by puffing itself up and blowing air past a flap of skin in its throat at the mouth of the windpipe, is unnerving.

How to tell a gopher snake. When you've been given a reception like that, it takes courage to stick around long enough to note the few features that unmistakably distinguish a gopher snake:

- A gopher snake's head is slim and pointed; a rattlesnake's is broad and roughly triangular, with heat-sensing pits just forward of its eyes. Unfortunately, a nervous young gopher snake may flatten its head enough to make it look quite like a rattler's.

- The gopher snake's brown markings are rectangular, the rattler's triangular.

- A gopher snake's body is far more uniform in thickness than a rattlesnake's, which is distinctly chunky in the middle.

- The pupils of a gopher snake's eyes are round; a rattler's are slits, like those of a cat.

- The tail of a gopher snake is long, slim, pointed—and, of course, has no rattles. The rattlesnake's tail is usually

quite short and plump, and the rattles at the end are plain to see.

The gopher snake and its cousins, the bull snake and pine snake, all belong to the genus *Pituophis*. They are essentially the same snake with three different local names. They have identical markings and characteristics. They interbreed. Gopher snakes and bull snakes have the same coloring. Pine snakes are black-and-white rather than brown-and-tan, though. Together, the hunting grounds of the genus cover nearly the entire nation, except for New England. Pine snakes are found from southern New York to Florida, and westward to Tennessee. Bull snakes, the biggest members of the genus, roam all over the Middle West and into Texas.

[Continued on page 216]



An air-cooled engine drives craft.



Paddle wheels pull the amphibian along at five-knot speed.

Paddle wheels drive land-water vehicles

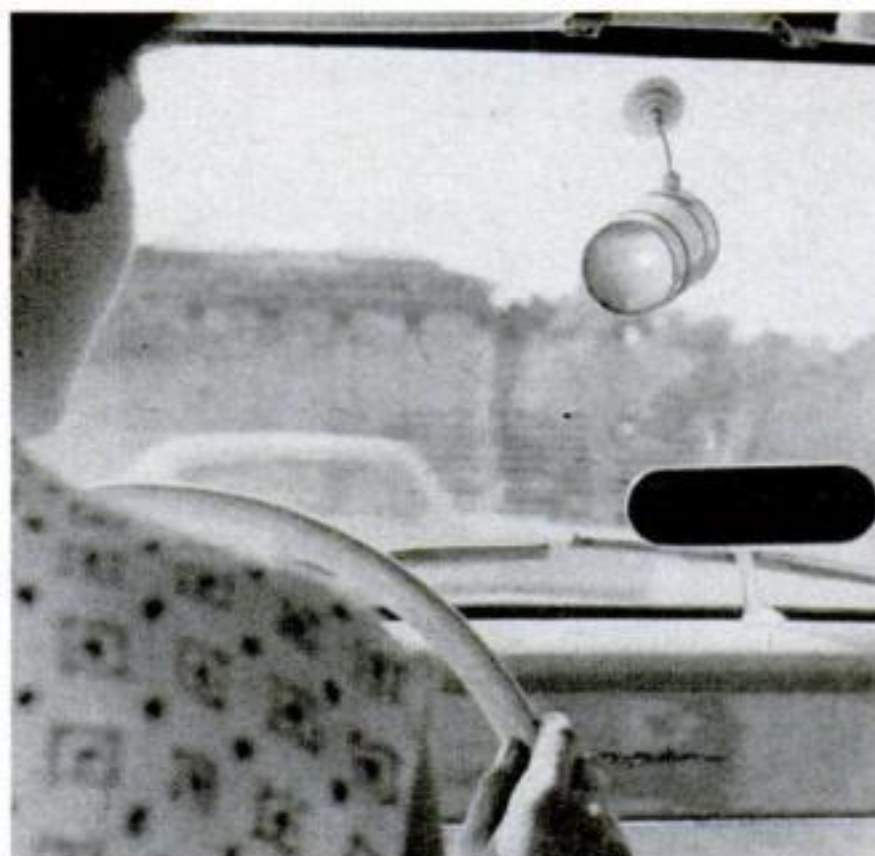
The same engine, transmission, and wheels propel this amphibious runabout on land or water. Boatbuilder L. G. Wood

of Whitstable, England, welded up a pair of wheels with paddle blades in place of spokes. Ashore, the vehicle rides on tire-



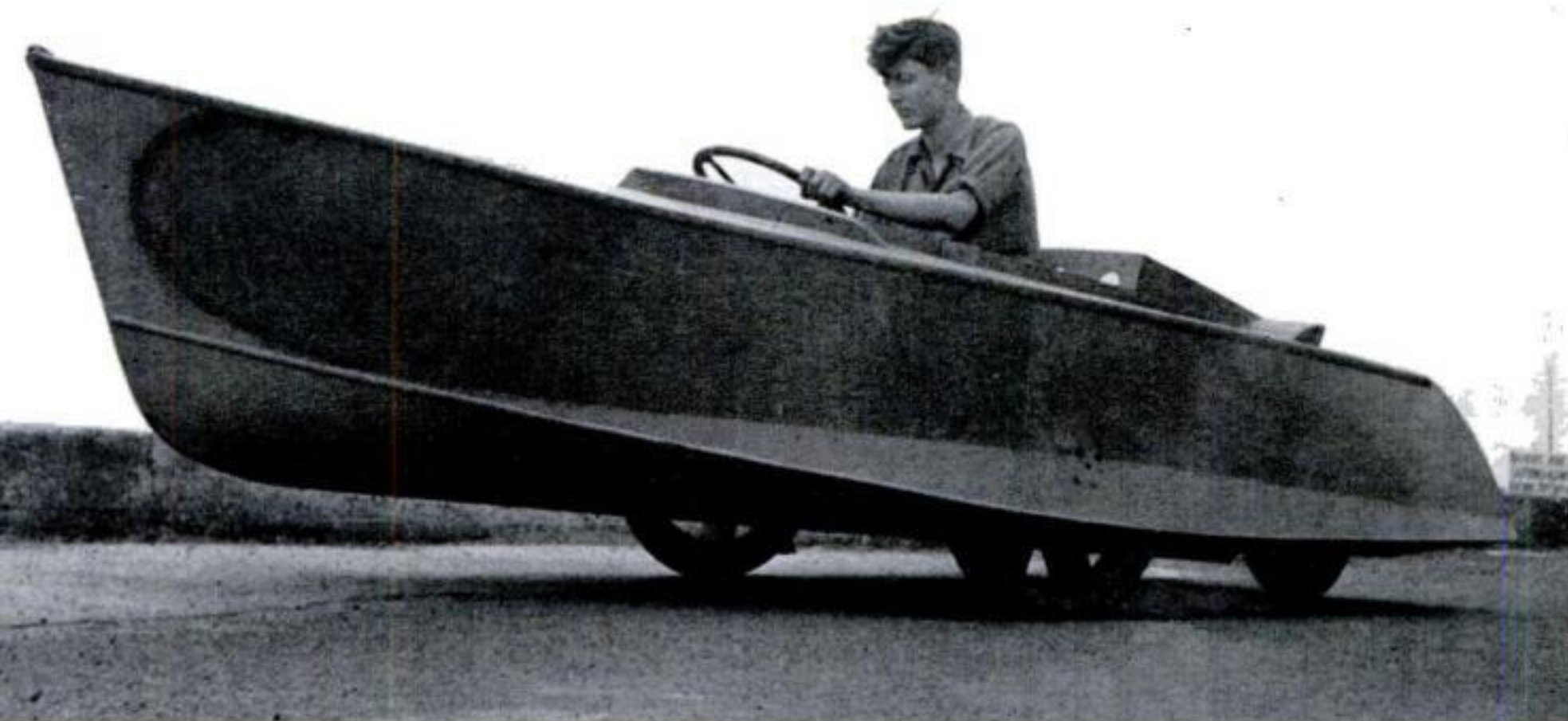
Halfway house

When builders purchased land for a new apartment building in New York's Bronx, they took half the lot on which this house stood. Then they left half of the house intact, with a new wall as part of the apartment building.



Private traffic light

This little reflector is attached to your windshield by a suction cup. Once adjusted in position, it catches the red and green signals, enables you to see overhead lights without craning your neck. It's made in Munich, West Germany.

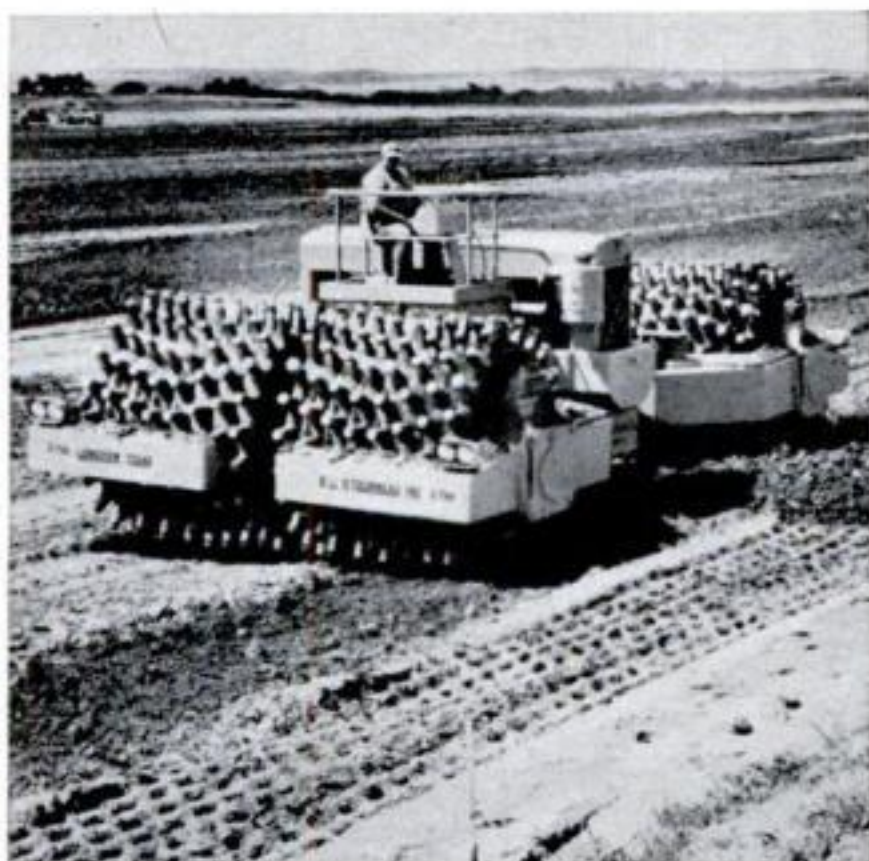


Single-seater runabout crawls out of the water and travels on rubber-tired wheels at 20 m.p.h.

clad wheel rims. Afloat it's propelled by the rotating blades. A small disk wheel, centered under the stern and turned by the steering wheel, controls the craft's direction ashore and afloat. It does five

knots in water and 20 m.p.h. on land.

The Anzani gasoline engine has two cylinders and is air-cooled. Wood expects to sell the amphibian locally for the equivalent of about \$850.



Sheepsfoot earth packer

The 45-ton roller above is equipped with hundreds of flat, circular "feet" to pack earth to any required degree of hardness. It is built by R. G. LeTourneau, Longview, Tex., for laying foundations for the construction of highways.



Skyscraper nurse

Wearing slacks and a protective helmet instead of the customary nurse's uniform, Mrs. Mary Sheehan is shown here on duty on the 52nd floor of a building going up in New York. She is employed by the contractor to care for injured workmen.

Tornadoes: Giant

**Scientists find new clues to the nature of twisters
in eyewitness accounts of their strange displays**

By Alden P. Armagnac

ON THE evening of May 25, 1955, a woman in Blackwell, Okla., looked out her front door at an eerie sight. Rising from the ground were forked lightning-like streamers of deep-blue electric fire, two to three feet high. Just beyond them was the black wall of a tornado cloud, bearing down upon her home.

Fleeing from the doorway, she took cover under a staircase—and lived to tell what she had seen. The tornado carried her half a block away, still beneath the stairway, which was all that was left of the original two-story house.



Stories of twisters' strange electrical manifestations, like the weird "lightning" this woman saw, have received scant notice in tornado lore published in the past. But their clues may lead to better understanding of a twister's workings—and so, in turn, save lives and property by helping to give timely warning of its birth and course. For a tornado, scientists now believe, must be

CONTINUED

DEEP-BLUE STREAMERS of forked "lightning," several feet high, were seen rising from ground by a woman in Blackwell, Okla., when she looked out her front door at oncoming tornado just before it struck her home.

Electric Machines



SPECTACULAR GLOWING RING of blue light, rotating in funnel of Oklahoma tornado, was viewed by weather observer Floyd C. Montgomery. This picture is based on sketch he made. From further data he supplied to scientists, they estimate the luminous display was 100 feet thick, and extended upward from a height of 800 feet above the ground. Its light illuminated small clouds circling around the funnel.



HOLES IN GROUND, too deep for an observer to touch bottom, and strip of turf rolled into ball, were found after tornado hit golf course at

Fargo, N. D. Lightning is known to dig such holes—and the unusual number and size of these gave evidence of the strokes' intensity.

some sort of an enormous electrical machine.

Twisters are spawned by "giant electrical storms," a kind newly recognized and named by science. Setting these apart from common thunderstorms are their huge dimensions (they reach into the stratosphere to 12-mile altitude, twice that of ordinary storms); the extraordinary frequency of their lightning; and novel electrical phenomena, completely unknown in other storms.

So concludes a remarkable Government report, "Giant Electrical Storms," just made public. It presents a study of tornadoes made for the Office of Naval Research by two Cambridge scientists, Dr. Bernard Vonnegut and Charles B. Moore of Arthur D. Little, Inc. A highlight of their report is a unique collection of eyewitness accounts of tornadoes' electrical displays.

Expert testimony. Tornado survivors have looked right into the whirling funnel as its open bottom passed overhead. Some saw continual lightning playing within it. Others reported a "luminous core" or "ring of fire"—a rarer phenomenon which, by good fortune, has occurred within sight of trained observers.

A tornado funnel aglow with dazzling blue light was a spectacular sight reported by Floyd C. Montgomery, a weather observer at Blackwell, Okla. Standing in the doorway of his storm cellar, he saw the tornado of May 25, 1955, hit the town, with a noise "like a roaring freight train, only louder." As the funnel passed 3,600 feet east of him, its upper part was a luminous band, "the same

color as an electric arc welder but much brighter—so intense I had to look away." The glowing band revolved "like a beacon lamp on a lighthouse." After the tornado passed, there was an odor in the air "like that of burnt sulfur."

From a sketch that Montgomery drew of the spectacle, its apparent size compared to buildings in his line of sight, and his position at the time, the Cambridge scientists estimate that the luminous layer was no less than 100 feet thick. Its lower edge, they figure, was about 800 feet above the ground. The display may have been an almost continuous electric arc or glow discharge, they suggest. Probably the "sulfur" odor actually came from ozone and nitrogen oxide, which would be formed by such an electric discharge.

From Montgomery, who talked with her afterward, also came the Blackwell woman's story of "lightning" rising from the ground in the same storm. Others saw St. Elmo's fire, a glowing type of electric discharge from pointed objects, just ahead of the oncoming funnel.

Sound effects, too. The sound accompanying a tornado, the report comments, "is frequently described as a humming or a buzzing like a million bees. It is difficult to see how a wind could cause such a noise; it appears likely that these noises may arise from intense point discharge. This conjecture appears reasonable in view of other observations describing what appear to be luminous electrical discharges from grounded objects very close to the funnel."

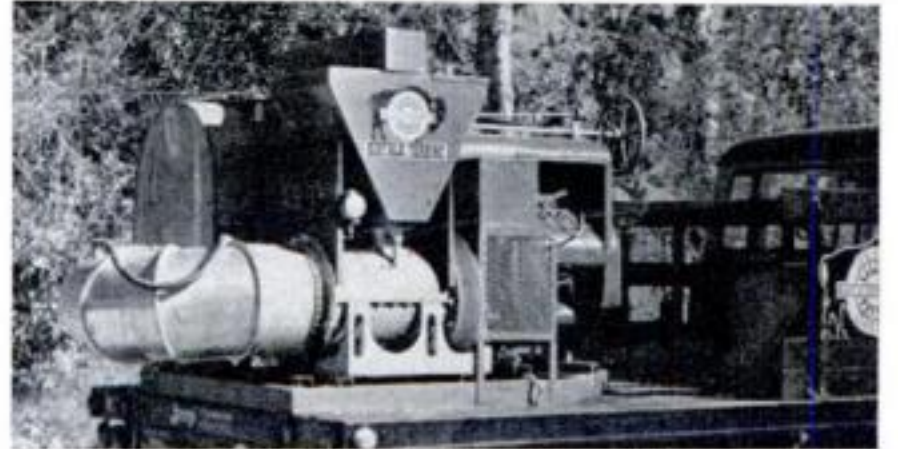
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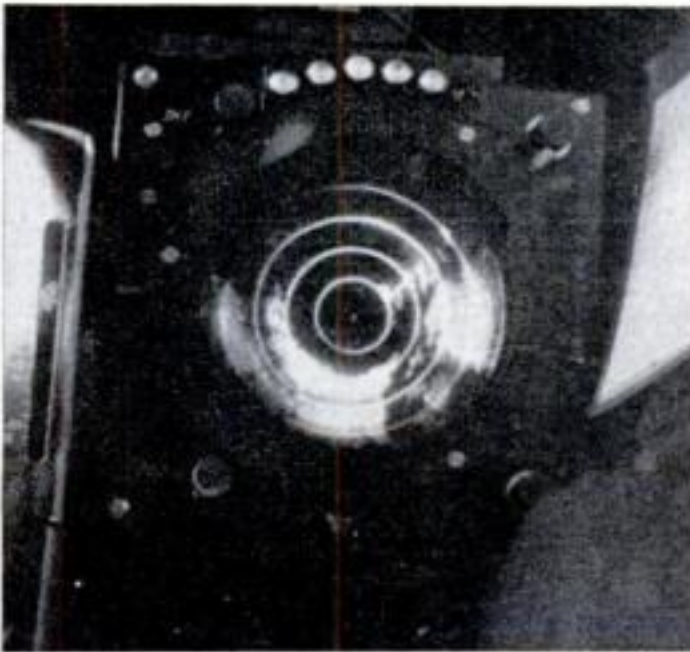
Two jets—one on trailer—open up on trees and brush from highway near Palm Springs, Cal.

Jet firefighter smothers forest blaze

A blast of borate spray from a jet turbine driven by a gasoline engine controls forest fires in California. The highly abrasive borate powder is introduced into the air stream just beyond the nozzle, can't wear it down. The blast can be tilted from horizontal to vertical and varied from a gentle breeze to a 180-m.p.h. hurricane. Unit is adapted from a farm duster.



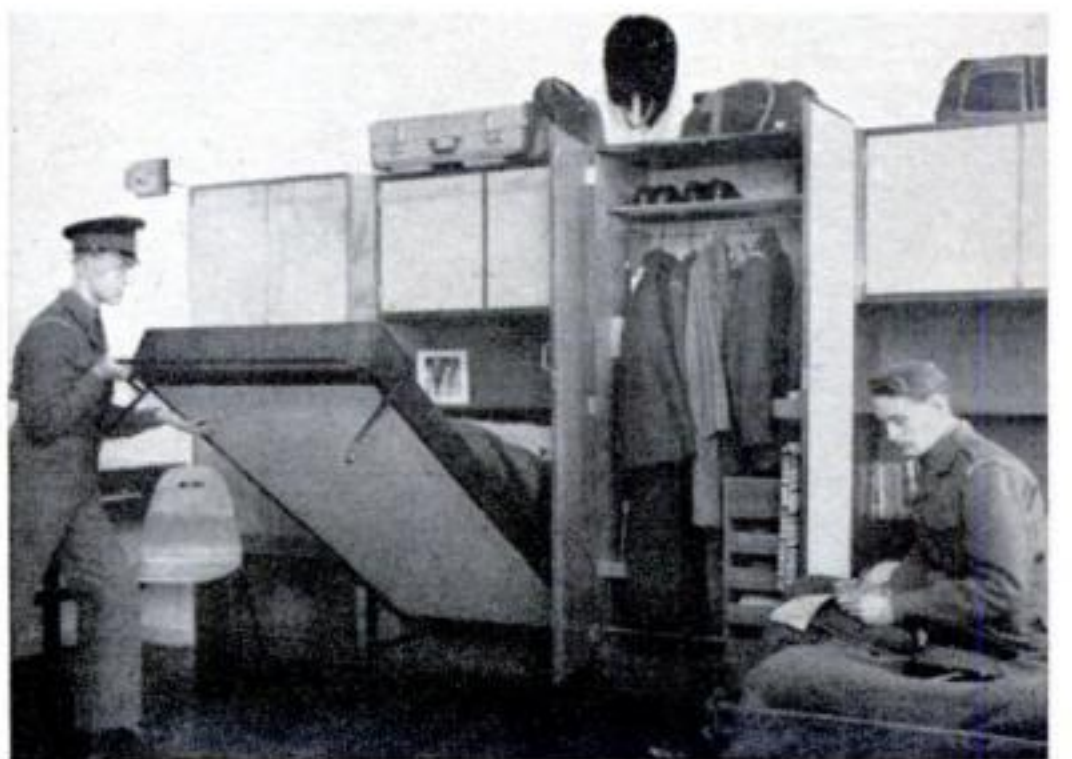
JET-TYPE BLOWER is mounted on a four-wheel-drive Jeep truck for use in rugged country.



Daylight radar

This new radar screen shows blips and cloud formations in bright sunlight. Its image is 1,000 times brighter than that of earlier indicators.

The equipment is being installed by Sperry Gyroscope Co. in cockpits of Air Force jet tankers, and cargo and troop carriers.



Folding beds for British soldiers

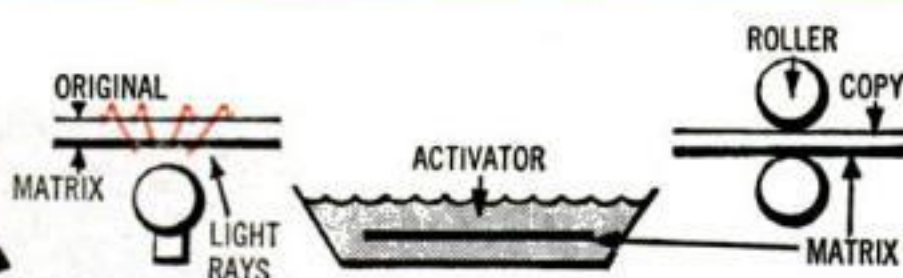
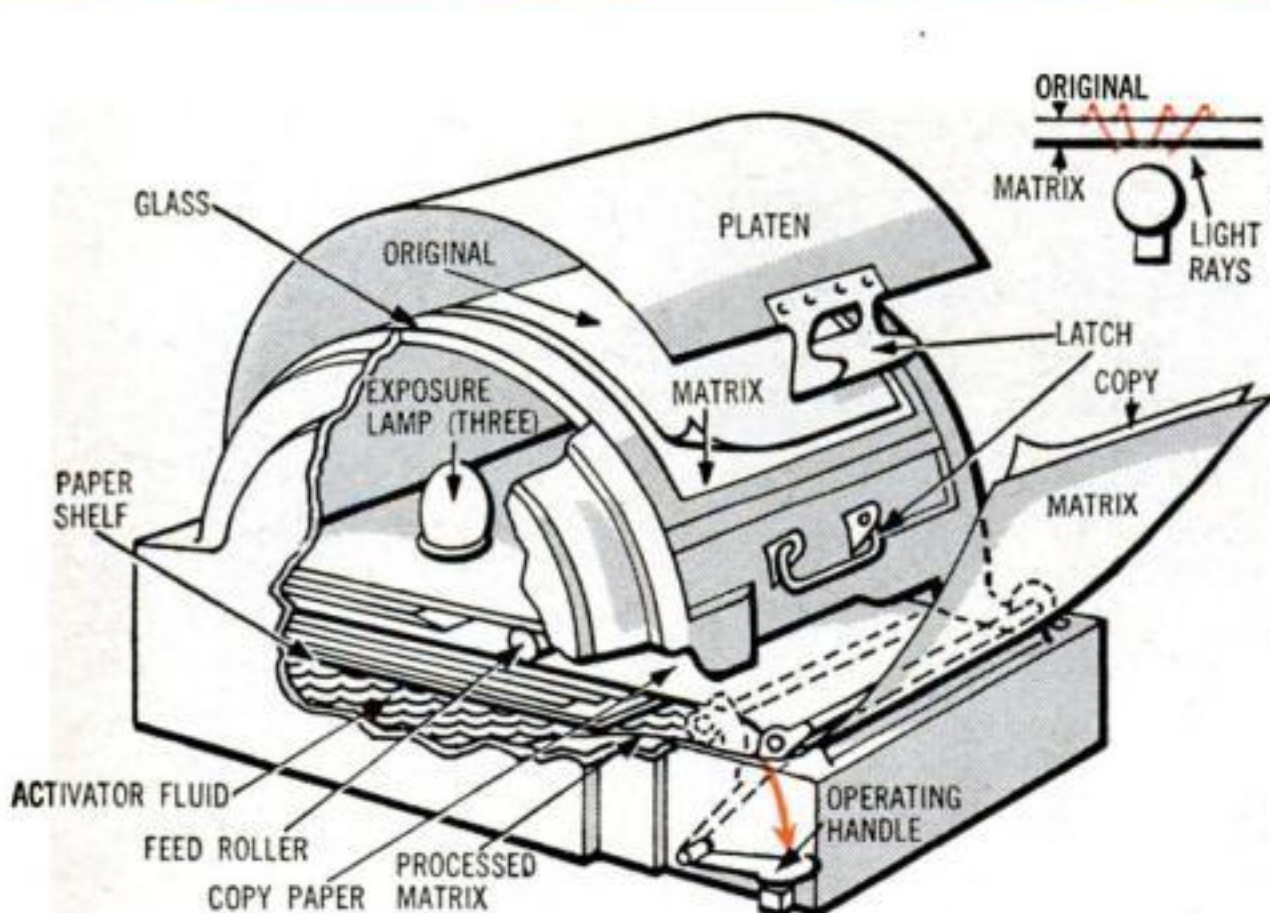
Beds in the fancy new London barracks of the Grenadier Guards fold into the wall with the bottoms flush with adjacent built-in lockers. Modernistic furniture in the newly finished rooms makes quarters cozy for the enlisted men.

How Copying Machines Work

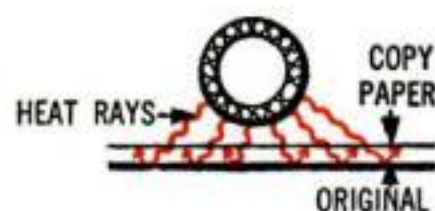
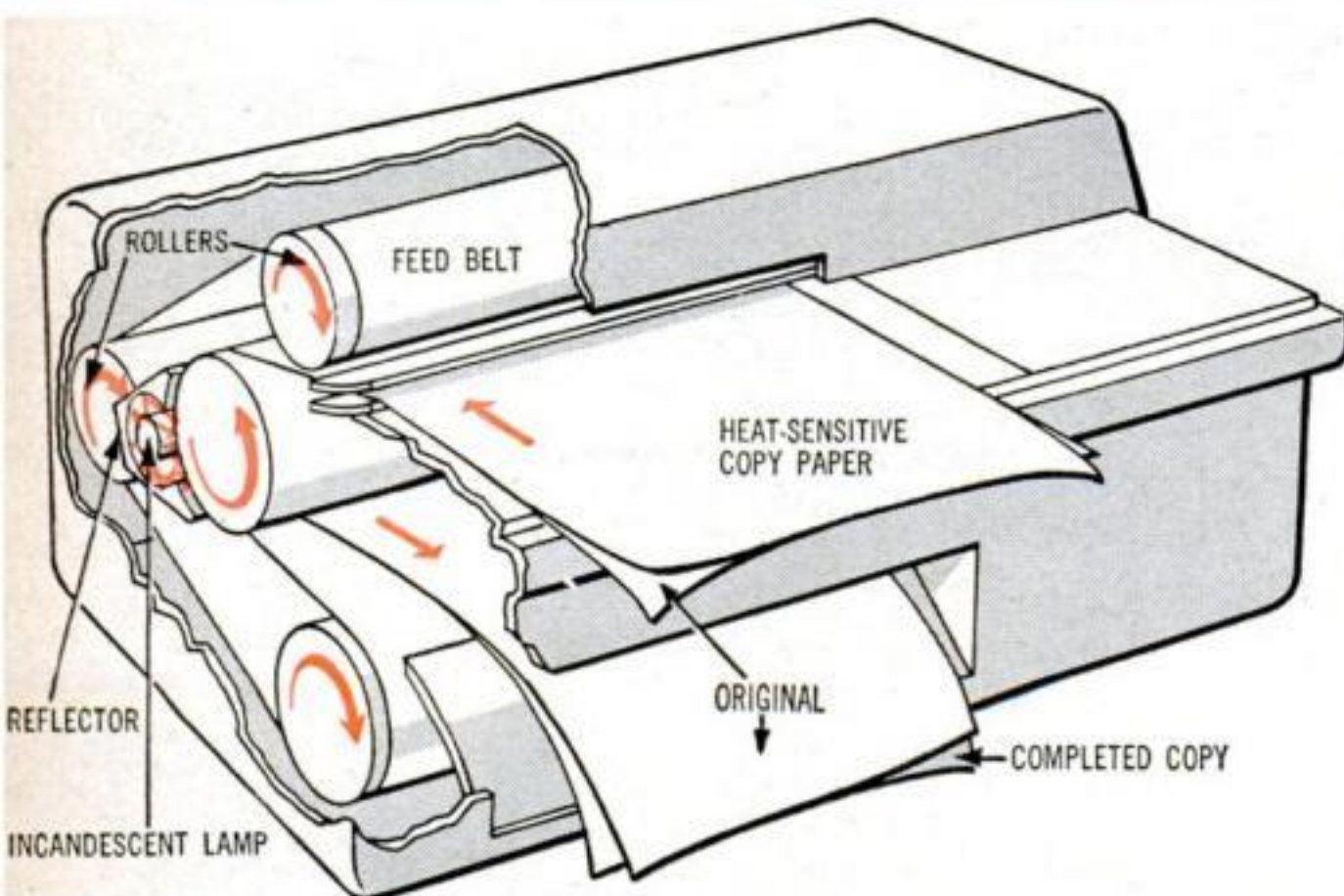
NOWADAYS when the boss asks for a copy of a letter, his secretary pushes the original into a little magic box and almost instantly pulls out a duplicate. To her, this is a lot easier than retyping the whole works. What impresses her boss is the cost: Instant copies (of anything, even drawings) average a couple of pennies apiece; retyping one

page can run to as much as three bucks.

Modern copiers have come a long way from the old blueprint machine that filled a corner of the drafting department. They're fast, clean, small. Most use the blueprint principle—chemical action induced by light—but there's also one type that works by heat, another that uses electrified powder.—*Phil McCafferty.*



DYE TRANSFER is secret of Kodak Verifax. Original to be copied is laid face down on dye-coated gelatin matrix atop glass plate. Light passes through matrix, bounces back from original to expose sensitized surface of matrix. Activator fluid then loosens dye in *unexposed* areas of matrix. When blank paper and processed matrix are squeezed together by roller, loosened dye sticks to paper, producing copy. One matrix will print about five copies before the dye gives out.



HEAT RAYS make copies directly — no developing — in Minnesota Mining (Scotch Tape) Thermo-Fax. Waxy duplicating paper darkens when heated. It is laid under original, and two are passed around tubular lamp. Heat rays from lamp pass through copy paper and are absorbed by dark areas—words or pictures — of original. These hotter areas heat up corresponding points on copy paper, darkening them.

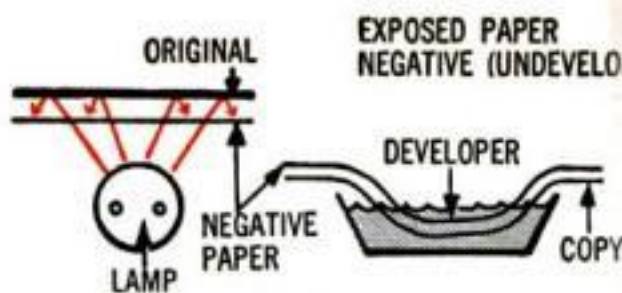
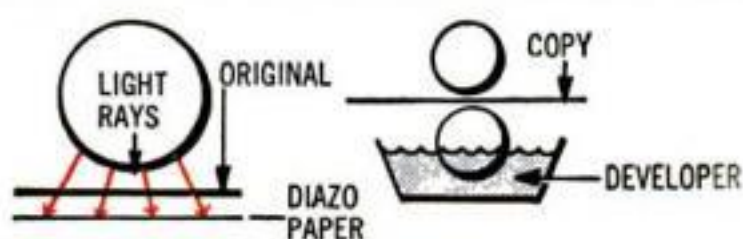
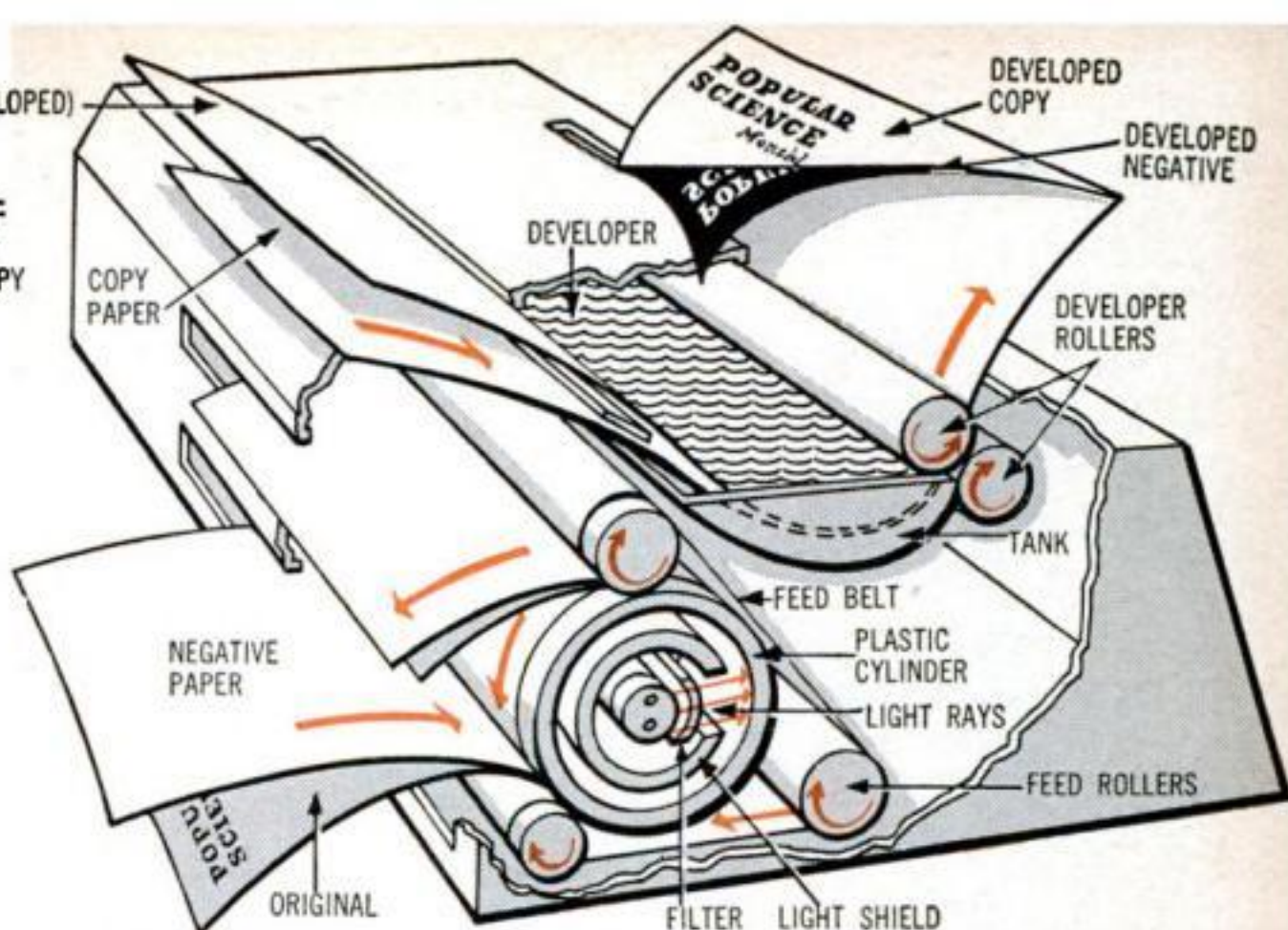
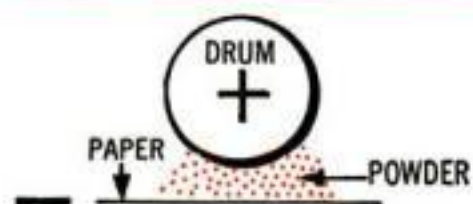
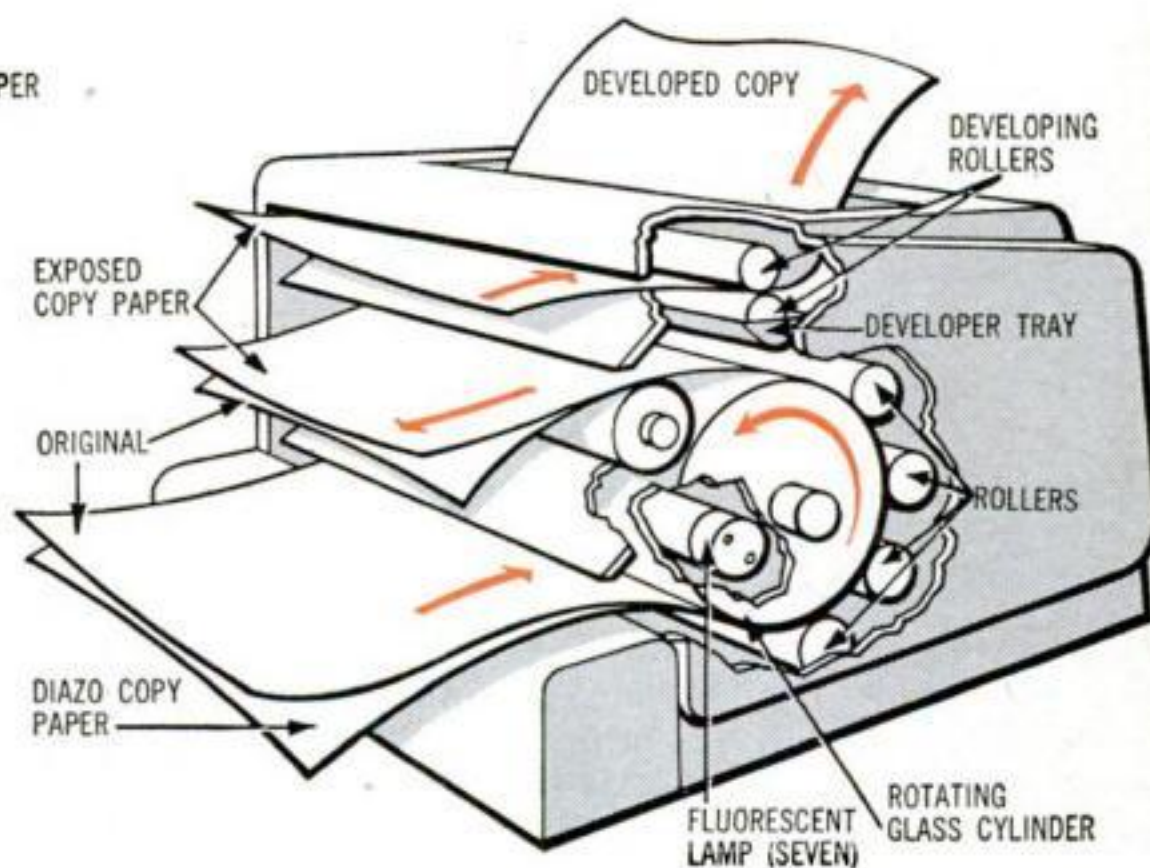


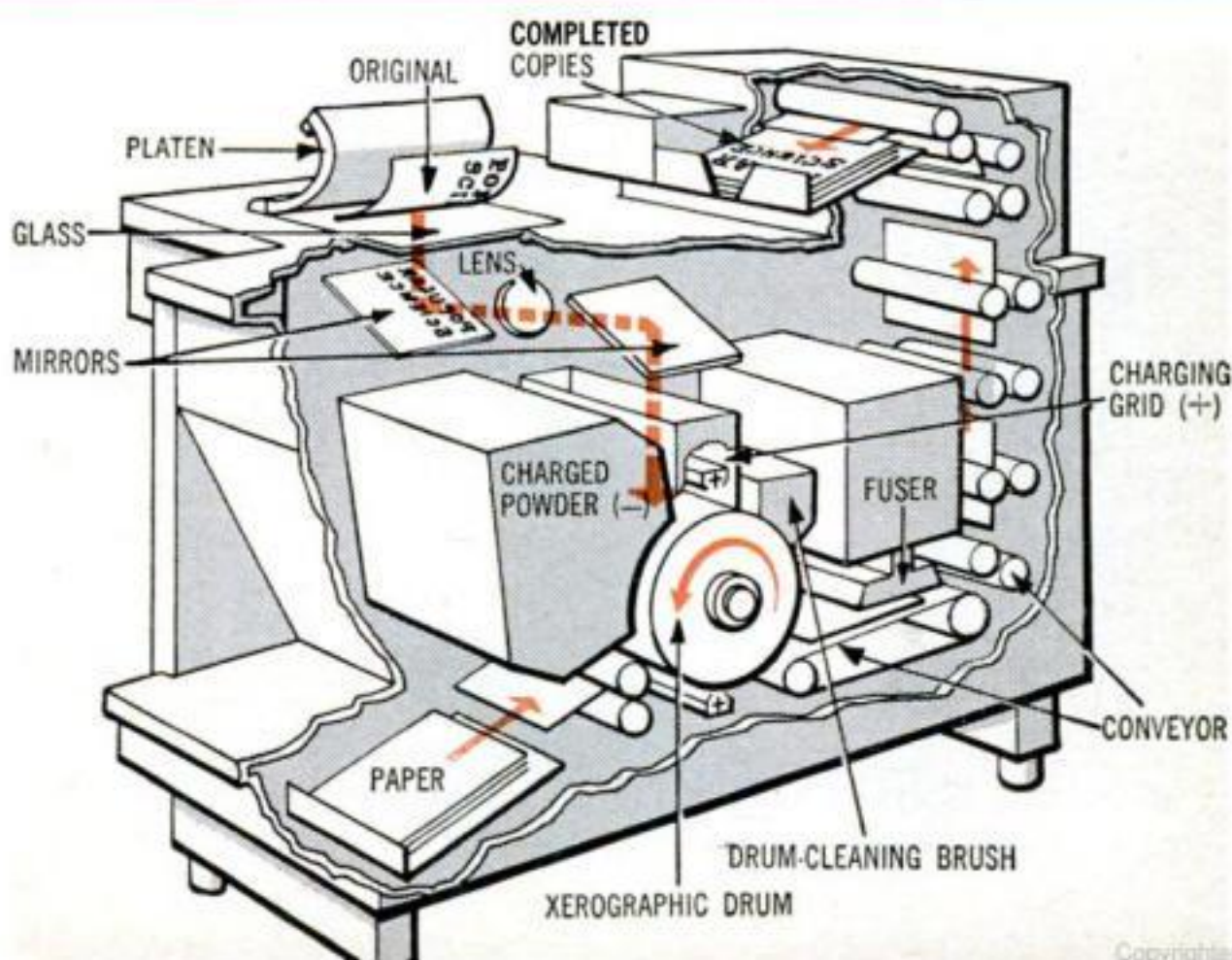
PHOTO TRANSFER is basis for several makes of copiers. Original and photographic paper are placed together and rolled around a filtered lamp. Light goes through photo paper, is reflected from original to expose negative. Negative and sensitized paper go into developer together, then between rollers. Developer action and pressure transfer image from negative to positive copy, which dries as it is peeled off.



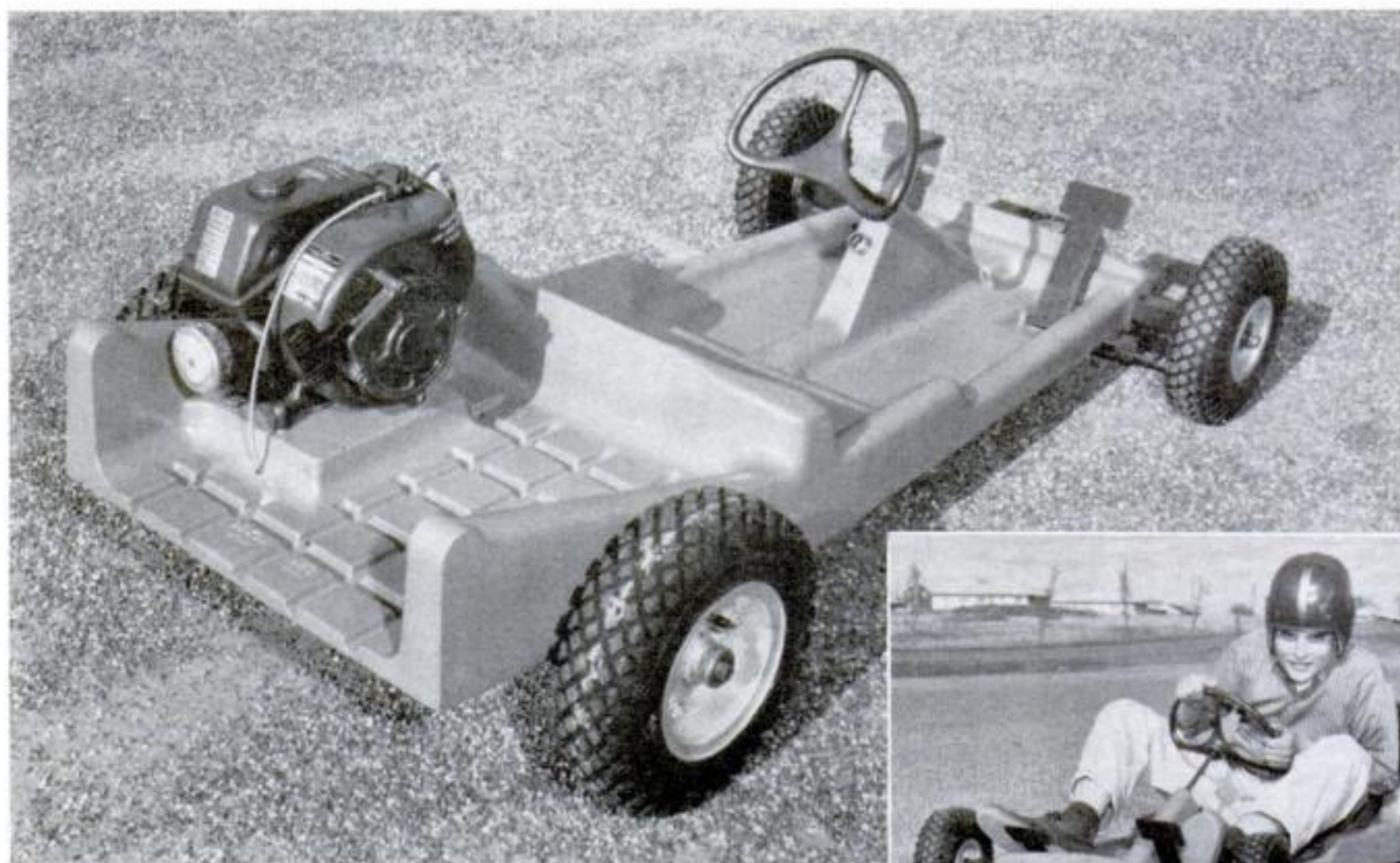
DIAZO PAPER makes direct positives in Bruning Copyflex. Original and diazonium-salt-coated paper pass around a rotating glass cylinder containing fluorescent lamps. Light from cylinder passes through original to desensitize diazo chemical wherever original is clear. Exposed copy paper then goes through rollers wet with developer, which darkens remaining diazo compound to produce the duplicate. Heat generated by machine is blown onto the moist copy to dry it off fast.



ELECTRIC PRINTING — Xerography — makes copies on any paper. Selenium-coated drum is uniformly charged with positive electricity by charging grid. Image of original is projected onto drum, which loses charge wherever light strikes (white areas of original). Negatively charged powder is then sprinkled on drum, sticking to charged (dark) areas. Paper, positively charged, attracts powder, which is fused on.



WHAT'S NEW.....



Tiny Racer Has Unit Frame

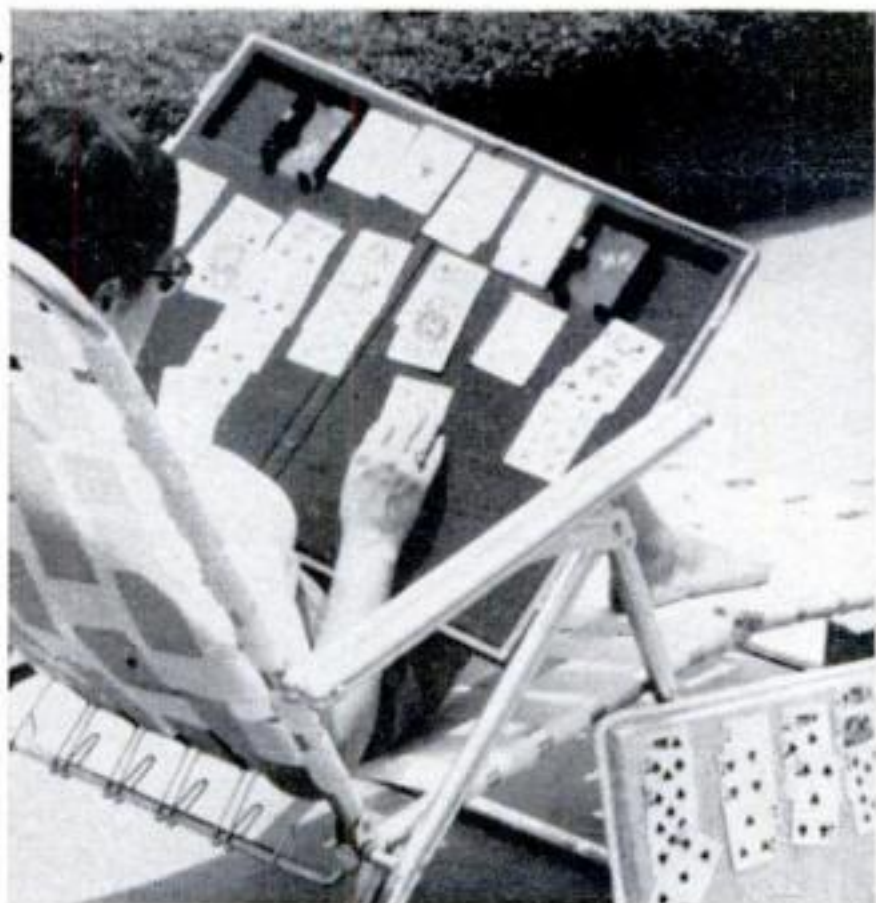
Unitized construction gives this new miniature car a one-piece body that won't wear out. There's nothing to come loose on its aluminum frame, no rattles, and no assembling necessary. It's built to mount a two- or four-cycle standard en-

gine at the left rear of the driver. The Dexon Dragon has been tested with 400-pound loads, clears the road by three inches, has a non-slip foot brake, and a front-end assembly with camber set at the factory. Dexon Mfg. Co., Minneapolis.



BANTAM CHAIN SAW

is powered by a 17-pound air-cooled gasoline engine, but will cut through an 18-inch log in 18 seconds. It's built for suburban use by weekend or occasional lumberjacks. You start it with a turn of the switch and a tug on the starter cord. It comes with 12-, 18-, and 24-inch bars at \$159.50 to \$179.50. Remington Arms Co., Bridgeport, Conn.



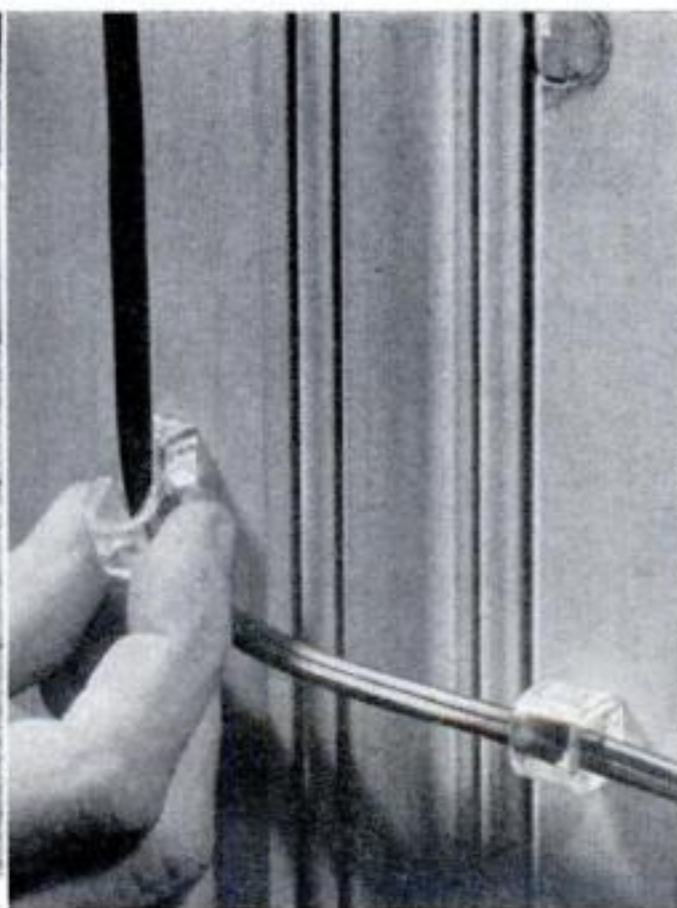
MAGNETIC CARDS won't blow away—no matter how windy—when you play on the beach or patio. Cards are made of plastic containing magnetic material; permanent magnets are embedded in the board surface. Price, \$9.95 to \$75. Magnetic Cards of California, 2314 Santa Monica Blvd., Santa Monica, Cal.



SPRAY-ON MIST REMOVER on the bathroom mirror above prevents fogging from shower-bath steam. It's also effective on windshields, windows, eyeglasses, and camera lenses. One application is good for days. At hardware and variety stores, 98 cents. Consolidated Research & Mfg. Co., New Haven, Conn.



PLASTIC CALKING is made of polyethylene in a variety of colors including white and aluminum. You can use it on concrete, cement blocks, bricks, and other masonry; apply it by knife or gun. West Chester Chemical Co., Box 39, West Chester, Pa.



TWO-PIECE CLIP is easily installed, holds wiring neatly on baseboard or other surface. You screw the base on, place the cord in its groove, slide on the C-shaped top. Lok-On clips are clear plastic. Card of five, 29 cents. John H. Lach, Culver City, Cal.



FAST PENETRANT frees nuts and other parts frozen by rust, varnish, or gum. Solvo-Rust contains solvents and detergents. It comes in three-ounce cans for automotive, shop, and garden-tool use. Permatex Co., Inc., 300 Broadway, Huntington Station, N. Y.

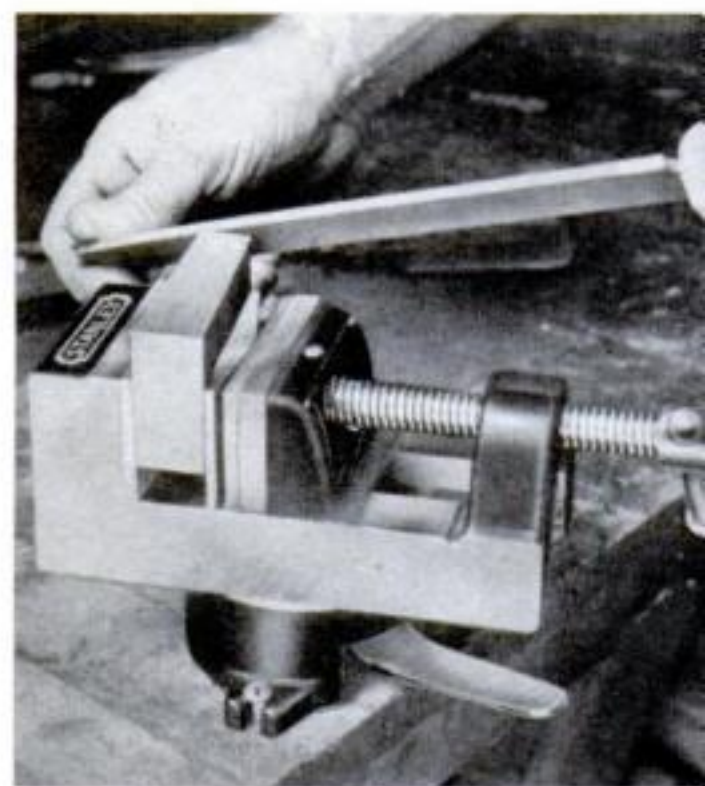
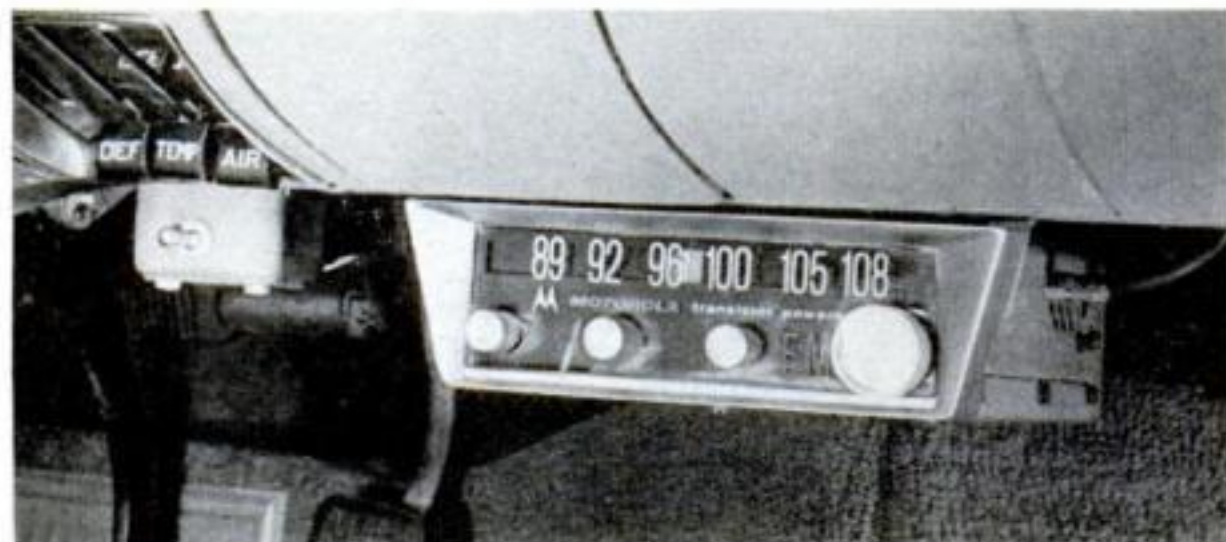


Webbed Mitts Add Speed in Swimming

The web-fingered design of these new rubber gloves provides a broader surface for extra power to push a skin diver or other swimmer through water faster and easier. The narrow wrist-band won't roll or let the gloves slip on your hand. They are flexible and lightweight so fingers are free to pick up and hold objects.

Swim Mitts are made in six junior and senior sizes: \$1.29 and \$1.50, children; \$2.50, adults. Pioneer Rubber Co., Willard, Ohio.

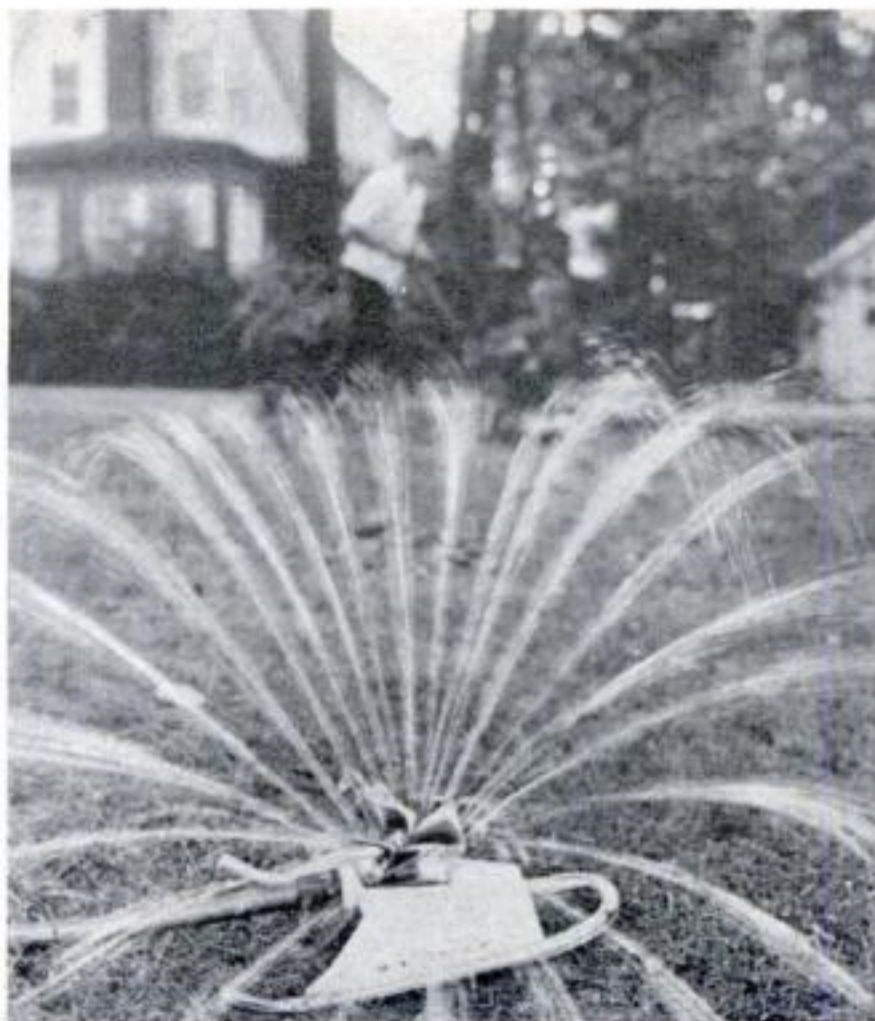
FM CAR RADIO is powered by three transistors and seven tubes. It's the first to be mass-produced in this country. The Motorola FM-900 is designed for mounting under the dash, has its own speaker, and operates independently of the AM set. It can be used in any 12-volt U. S. car built since 1955 or any 12-volt vehicle having negative-ground ignition, including boats and foreign cars. \$125. Motorola, 4245 W. Augusta Blvd., Chicago.



DUAL VISE can be mounted either on your bench or on a drill press or other machine. Its dovetail slot and cam-lever clamp lock it at any angle while permitting it to swivel. Two sizes, 2 $\frac{1}{4}$ - and three-inch jaws. Stanley Works, 195 Lake, New Britain, Conn.



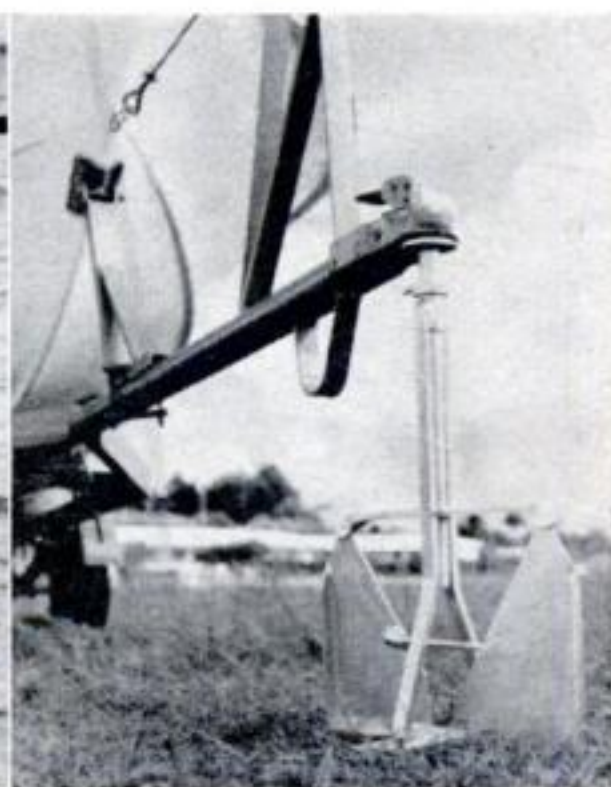
PORTABLE SPOTLIGHT built like its lantern-battery older brother, operates on three D flashlight batteries in a detachable case. Radar-Mate is compact enough to fit in your glove compartment, yet throws a powerful beam. The lamp head swivels in a 135-degree arc. \$4.98. Burgess Battery Co., Freeport, Ill.



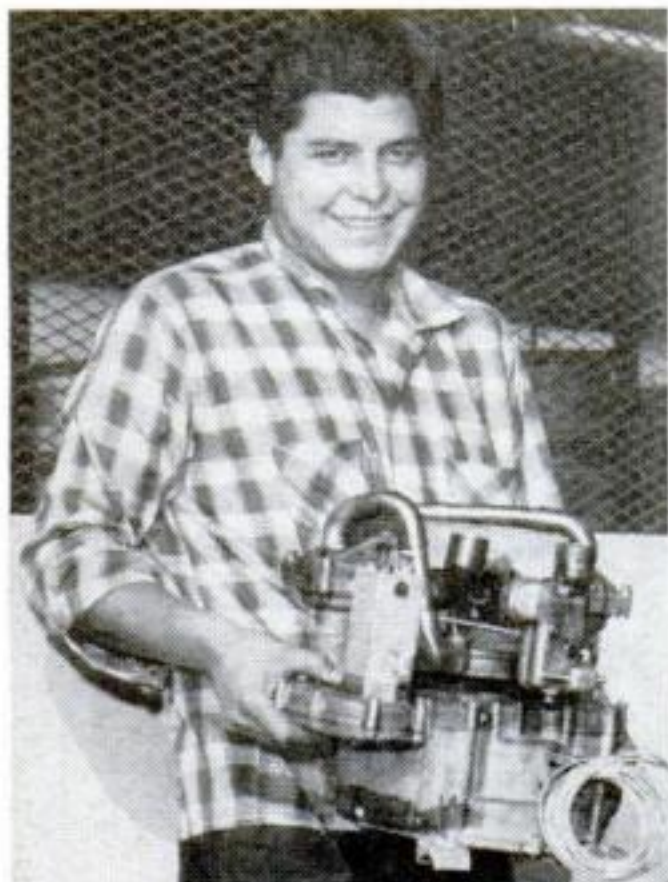
SQUARE SPRINKLER puts all its water on a small lawn, none on the sidewalk or driveway. It sprays in a square pattern two by two feet up to 35 by 35 feet in area, sufficient for watering a medium-size garden without waste and with a single setting. Price, \$2.49. Melnor Industries, Inc., Moonachie, N. J.



MULTI-LEVEL contains a steel ball in a one-inch clear-plastic segment of a 12-inch sphere. With one operation it shows the low point in any direction of a turntable or other object under test. 60 cents. F. H. Hagner, 1010 Navarro St., San Antonio, Tex.



DOUBLE-PURPOSE ANCHOR holds your boat steady on land or sea. Used in water, it has a rope ring that slides on the shank to make it snagproof and facilitate recovery. On land, a squared-off base allows it to serve as a supporting post under the tongue of a boat trailer, making blocking unnecessary. The height of the shaft can be adjusted and locked to assure adequate drainage while the craft is in storage. Stan-Anchor is available in seven-, nine-, and 13-pound sizes at \$12.70, \$13.90, and \$16.90. Biscayne Tank Mfg. Co., 6940 S.W. 12 St., Miami.



Now They're Making Midget Diesels

*They're rugged, compact, and light—
one weighs just 16 pounds. Another's
the world's lightest diesel outboard*

WHEN Rudolf Diesel fell, jumped, or was pushed off a steamer in the middle of the English Channel 47 years ago, his engines were already the world's most efficient. But, for their power, they were too big and noisy. Since then, they have been progressively slimmed down in relation to their muscle, and considerably hushed. For the most part, though, they have been limited to large prime-moving jobs.

Now, for the first time, a whole family of little diesels for smaller jobs is being built in Los Angeles.

The diesels that are just beginning to emerge in California, where they are made by American Marc, Inc., are all midgets, as diesels go. They are intended to invade fields that little gasoline engines have previously had to themselves.

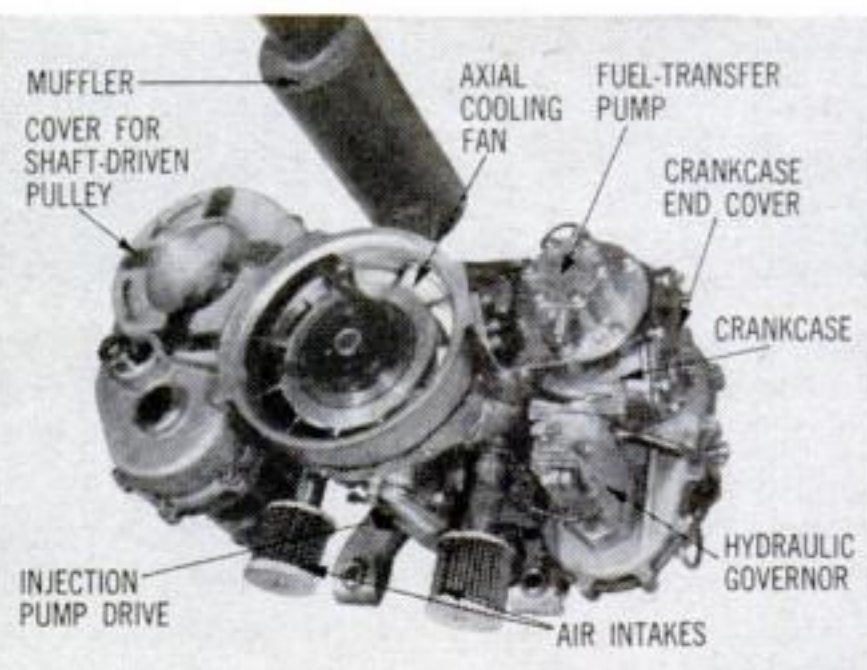
The baby of the new tribe is the smallest diesel ever built for practical purposes. A single-cylinder, two-cycle, opposed-piston engine, it weighs only 16 lb. (see photo at top of page) and is not much bigger than a typewriter. It produces $1\frac{1}{2}$ hp. Its role is to ride on the front bumper of a Marine Jeep and drive a generator to supply current for a radio transmitter.

Slightly bigger and guttier models—three hp. and $7\frac{1}{2}$ -8 hp., respectively—drive power plants for lustier Jeep-riding transmitters of 1,500 and 2,500 watts. All three are air-cooled.

A water-cooled version is creating a stir in boating circles right now. At maximum operating speed (3,500 r.p.m.) it develops $9\frac{1}{4}$ hp. It has two opposed pistons in one cylinder, weighs about 90



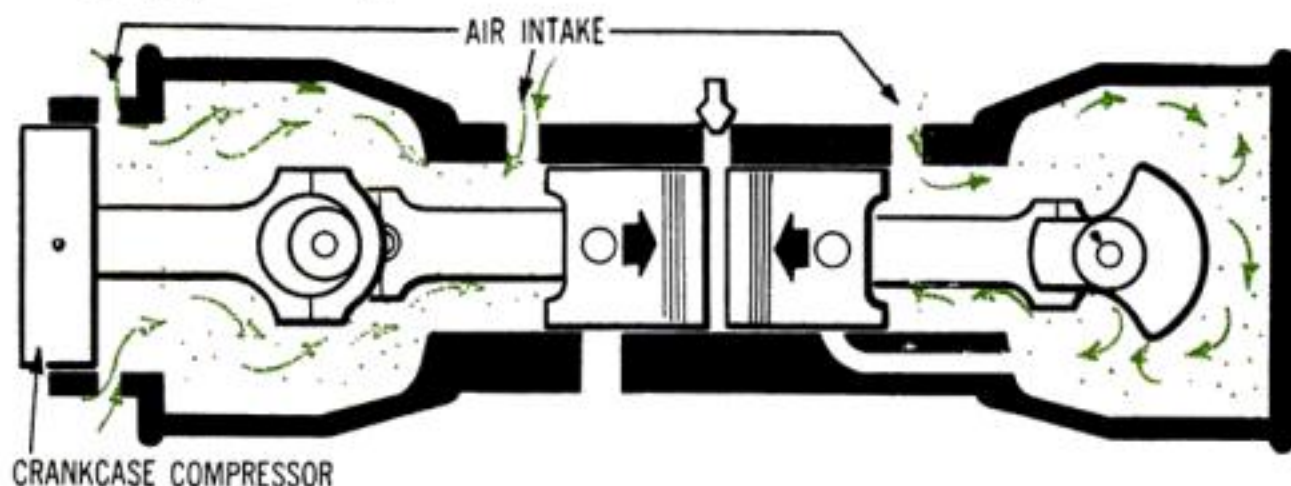
POWER FOR A FIELD RADIO is supplied by the bumper-riding, $7\frac{1}{2}$ -hp. American Marc diesel above. The air-cooled engine, shown at right



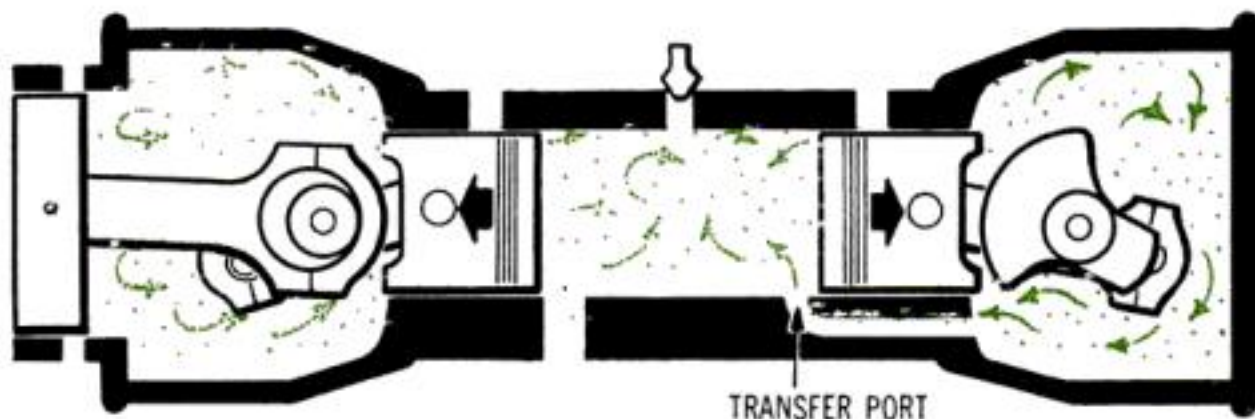
dismounted from the Jeep, has two pistons working in one cylinder and is built largely of aluminum to keep weight to a minimum.

Here's how pint-sized, opposed-piston diesels work

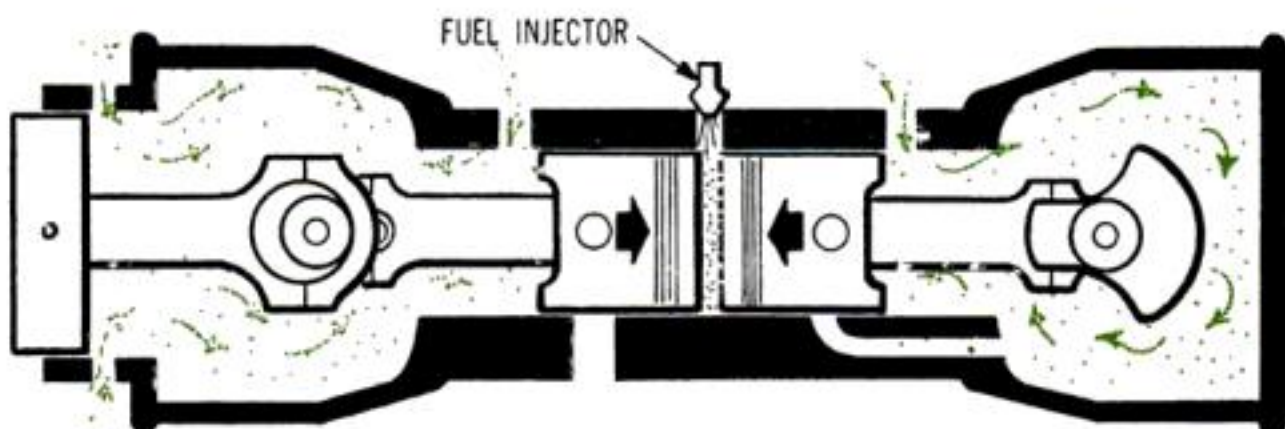
1 Air is drawn into crankcases when pistons are in this position at the top of the intake stroke. Simultaneously, combustion is occurring in the cylinder, as can be seen in Diagram 3.



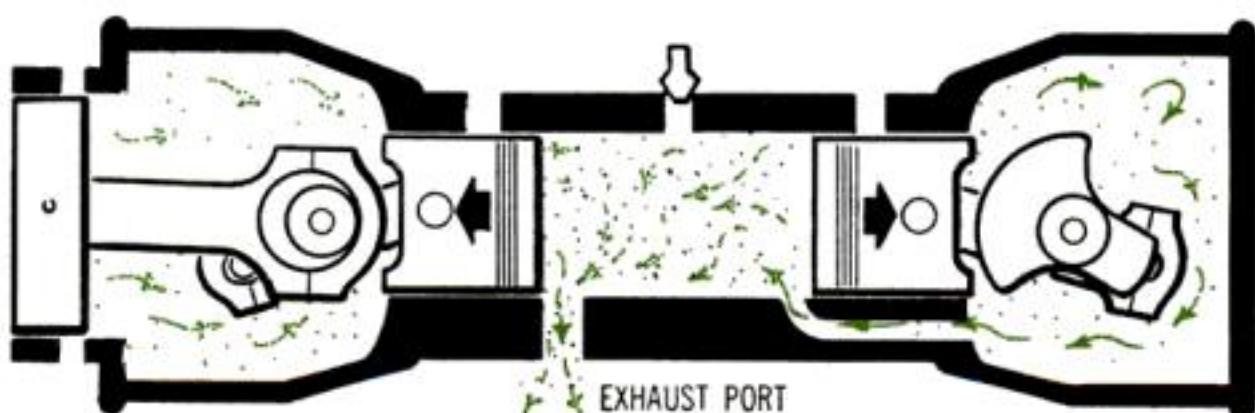
2 Pistons move down, forcing air in crankcases into transfer passages. When transfer ports are uncovered by the piston, air rushes out into the cylinder to be compressed.



3 As pistons reach top center, air is greatly compressed and reaches very high temperature. Fuel, injected into the cylinder, is ignited by heat of compression, forcing pistons apart.



4 Exhaust port is uncovered by one piston slightly before BDC. Transfer port is also uncovered as piston motion continues. Air rushes in, forcing exhaust gases out fully opened exhaust port.



pounds, and is the first lightweight diesel outboard produced.

The builders tick off these arguments in its favor:

- With a compression ratio of about 23:1, three times greater than that of most gasoline outboards, it provides tremendous torque.

- It consumes only half as much fuel as a gasoline outboard of equal horse-

power. Moreover, diesel fuel is roughly half as expensive as gasoline.

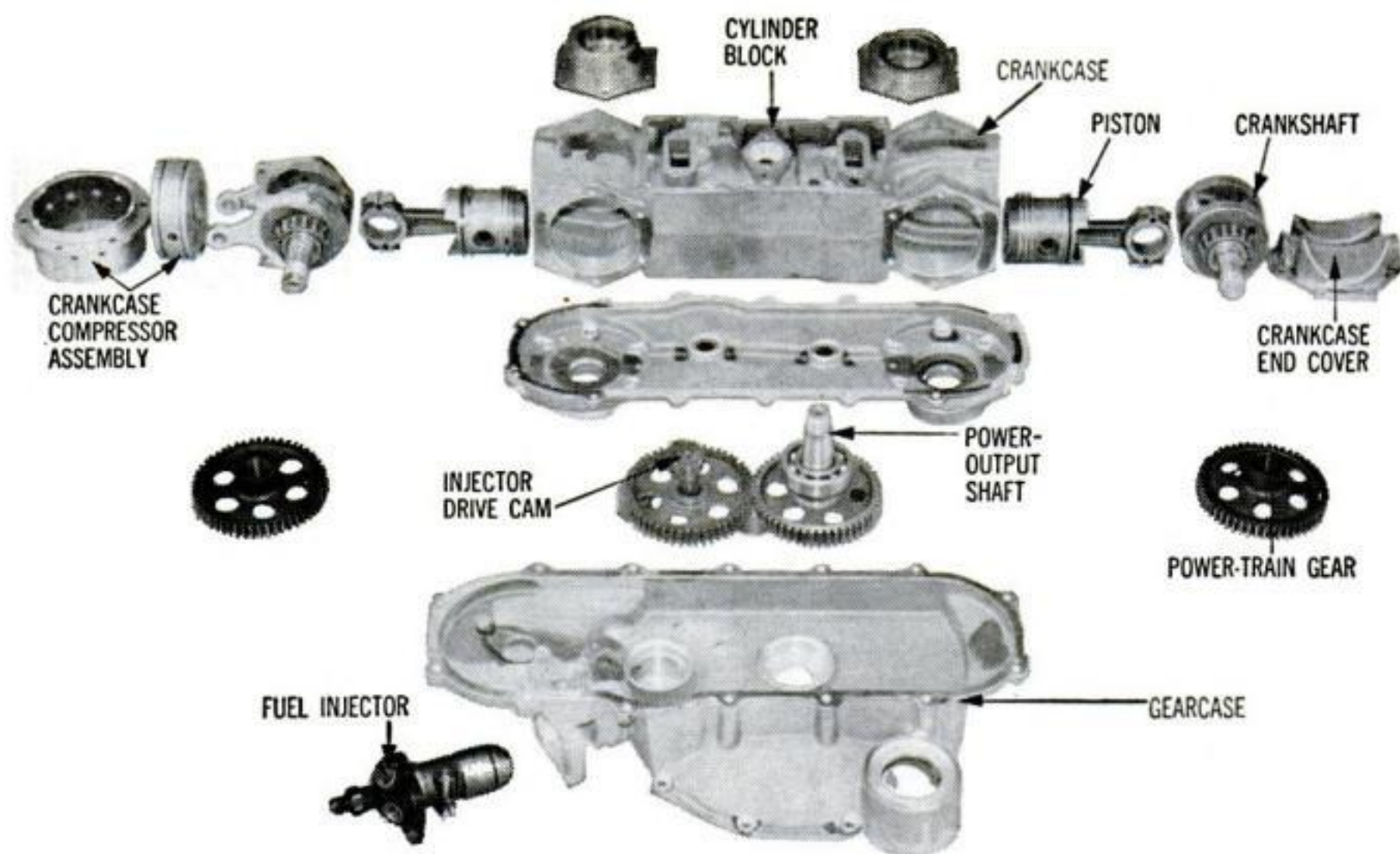
- Having no spark plugs, carburetor, magneto, valves, valve springs, push rods, rocker arms, or camshafts, it is easy to service and maintain.

- It starts dependably (by battery) in any weather in which a boat owner would be likely to use it. It needs no warm-up.

- Being both simple and exceptionally

CONTINUED

III



SIMPLICITY: Exploded view of small diesel shows substantially fewer parts than found in normal

gas engines. There are no spark plugs, camshafts, distributor, valves, or valve springs.

sturdy (to withstand its high compression), it is very durable. "A good diesel ought to last at least 10 times as long as a good gasoline engine," one maker says.

- There is less fire hazard.
- The engine is nearly vibrationless,

because the opposed pistons balance its reciprocating forces.

The builders feel these advantages more than offset the two disadvantages of the diesel outboard: It weighs about 30 percent more than a comparable gasoline outboard, and costs more—\$485 list.

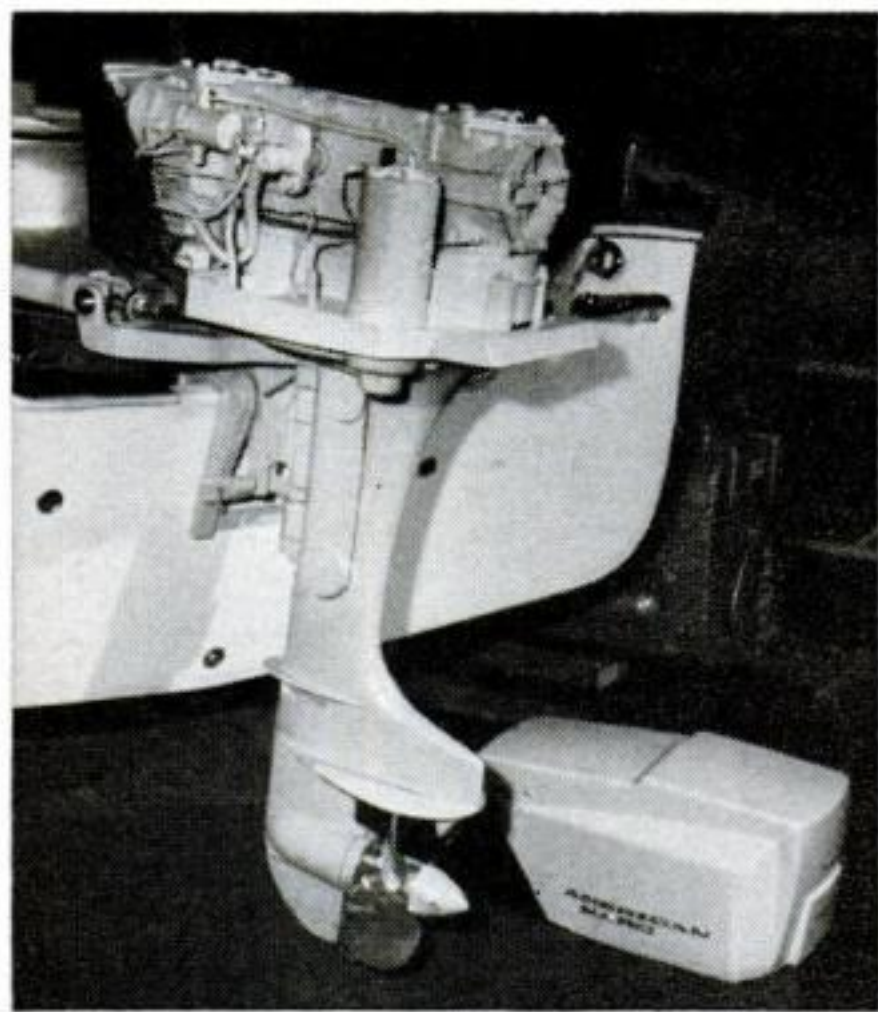
On the way at American Marc are 16-18-hp. and 30-hp. diesel outboards, and a 35-50-hp. inboard-outboard, weighing only 220 pounds.

The company has also developed a 12-hp. diesel oil-well pump that costs nothing to run. How's that? For fuel, it uses natural gas, which the well automatically produces.

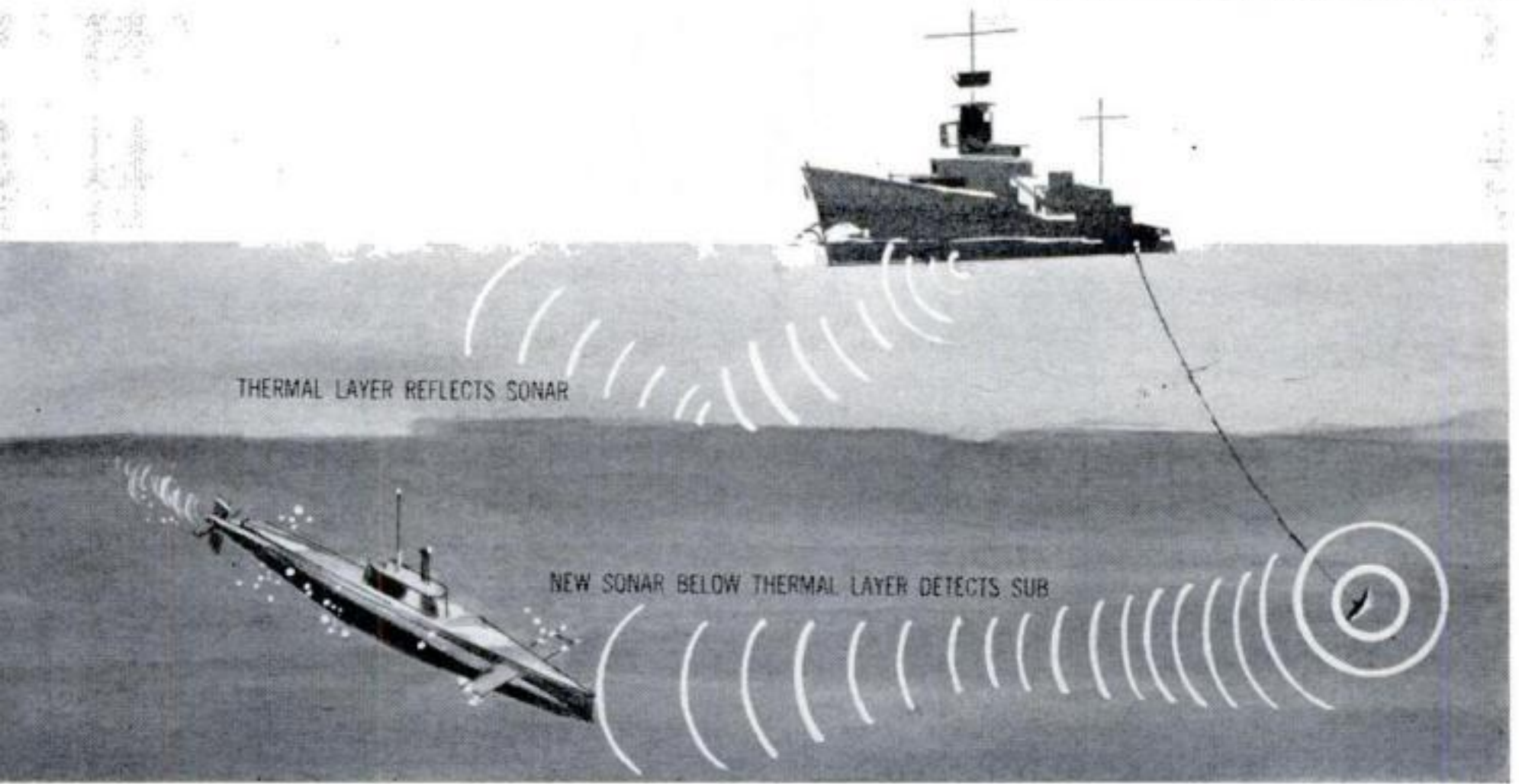
It couldn't be done, but. This diesel invasion of gasoline-powered territory didn't happen spontaneously. It is based on a radical new engine design—which diesel experts at MIT and in the Navy's Bureau of Ships said wouldn't work—and a maximum use of aluminum.

There's normally nothing extraordinary about a diesel engine that has one cylinder, opposed pistons, and a two-stroke cycle. But this one is unique. It is self-scavenging. In two strokes, it not only performs the usual functions of intake, compression, combustion, and exhaust, but expels the burned gases from its

[Continued on page 230]



FIRST LIGHTWEIGHT DIESEL OUTBOARD weighs just 90 lb. and puts out $9\frac{1}{4}$ horsepower. It's claimed that it uses just one-half gallon of low-priced diesel fuel per hour.



New sonar pierces submarine screen

The Navy's sub-hunting destroyers now drop their sonar gear deep into the sea to catch enemy underwater craft hiding beneath a layer of water where the tem-

perature changes sharply. Previously, lurking submarines could use such thermal layers as shields—they bounce back the sonar signals as effectively as a mirror.



Hospital-room cafeteria

Patients in the John Sealy Hospital in Galveston, Tex., are served piping-hot meals in their beds from six of these mobile cafeterias. The rolling units contain both heating and refrigeration compartments. Each, wheeled from ward to ward, will serve 100 patients.

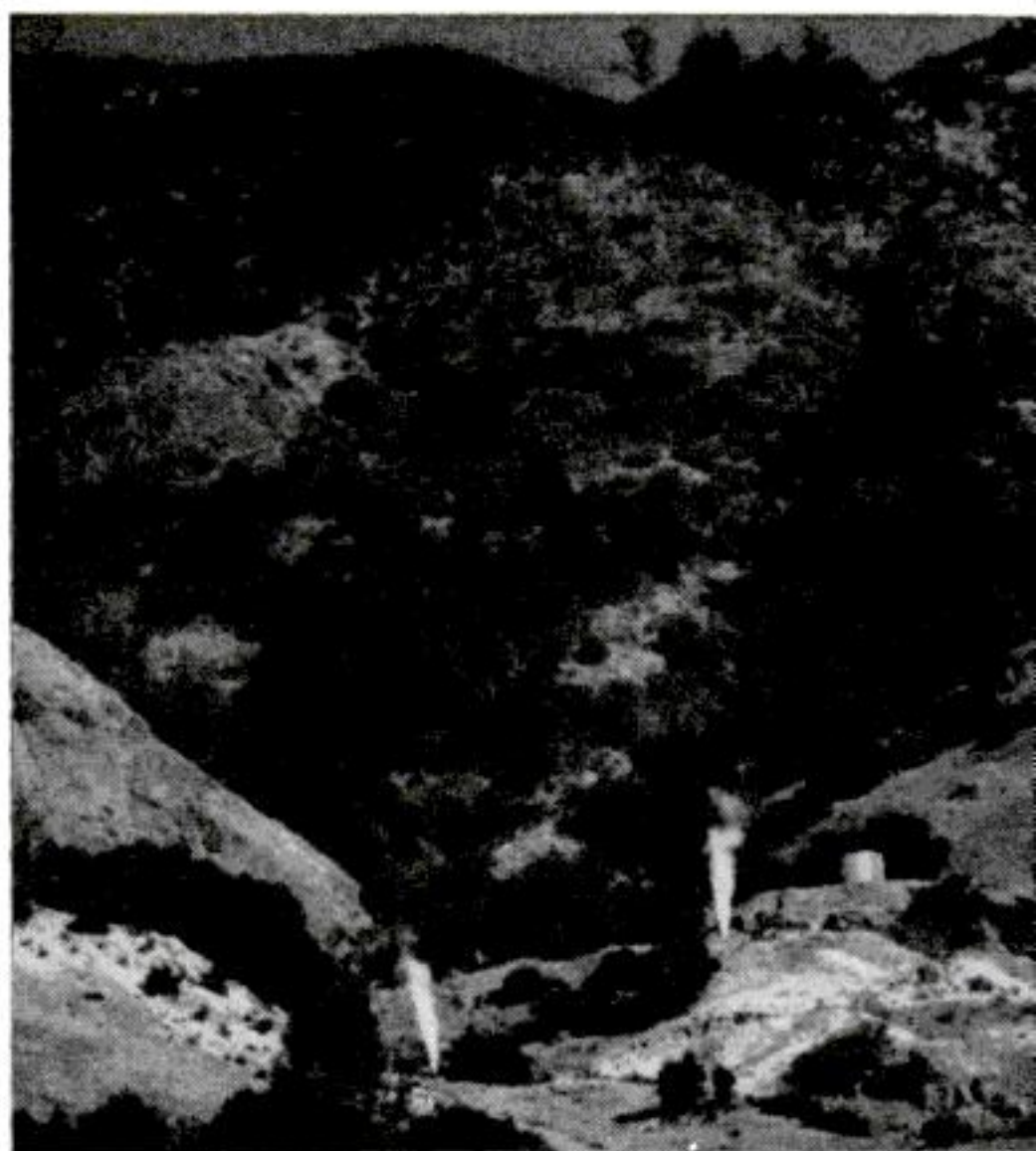
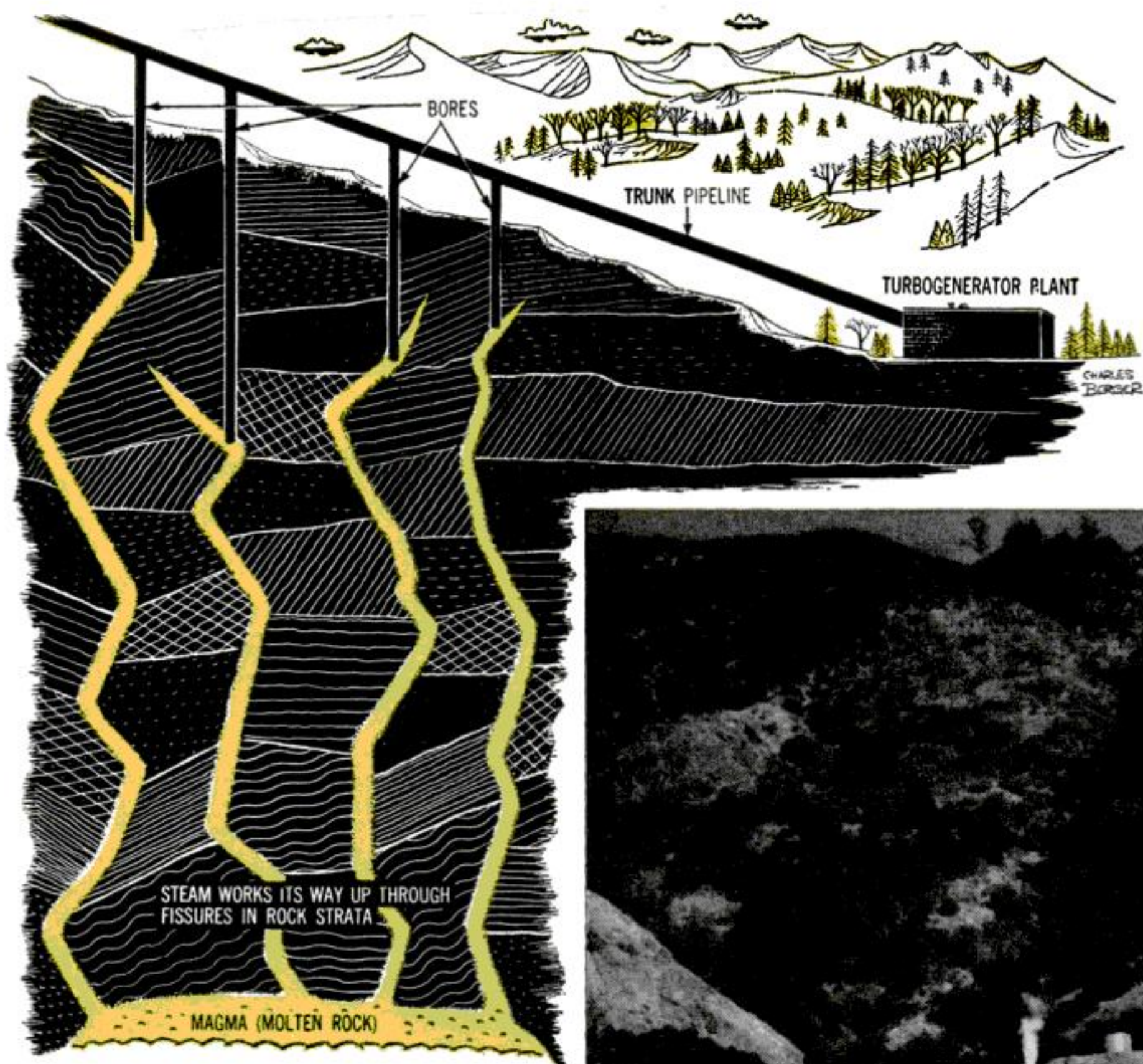
Comfortable steam bath

How to keep a cool head in a steam cabinet was demonstrated in London by the cabinet's inventor, Dr. C. F. Lyburn. The upper part is refrigerated while the lower body gets a full steam treatment.



Drawing Power from Nature's Steam Boiler

Tame volcanoes under California's "hot lands" are being harnessed to make cheap electricity



STEAM JETS THREAD UPWARD through underground rock cracks. They are tapped by wells drilled to depths of 300-800 feet and capped.

JUST BLOWING OFF STEAM, after drillers have opened them up, these steam wells will be tapped by pipelines and their steam pressure

By Paul Corey

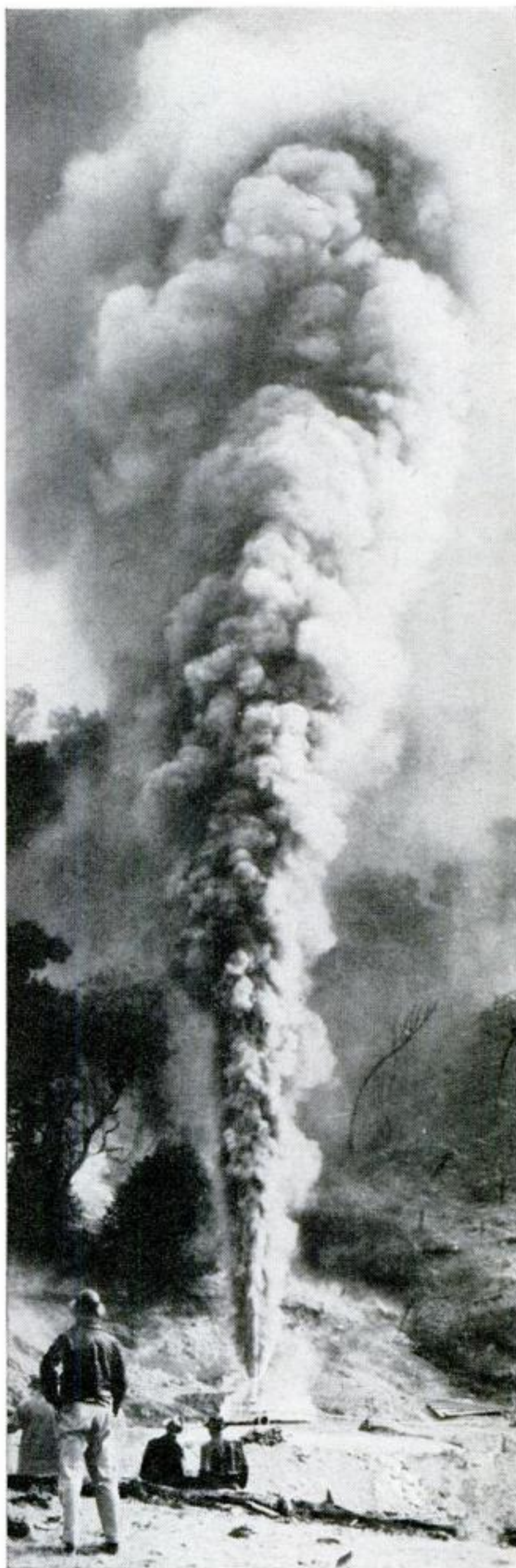
BIG GEYSERS, they're called. Eleven of them now spout on a brushy canyon side 70 miles north of San Francisco. Going full blast they shake the valley of Big Sulphur Creek with an ear-busting roar—and it isn't roses you smell. Even when they are capped and silenced to a whisper, the country around seems to throb with the muted power of a giant teakettle.

These wells are owned by Thermal Power Co. and Magma Power Co., which hold a lease on 3,200 acres of "hot lands" in this area. They have contracted to deliver steam to a condensing turbogenerator, to be built by the Pacific Gas & Electric Co., 1,000 feet along and down the side of the canyon. The steam will flow at a rate of 265,000 pounds an hour, a pressure of 100 pounds per square inch, and a temperature of 348 degrees F.

One of these wells alone could deliver that much. But, to insure plenty of reserve steam right from the start, three or more of the wells will blow their hot breath into the insulated delivery pipeline. The 11 wells have a total estimated

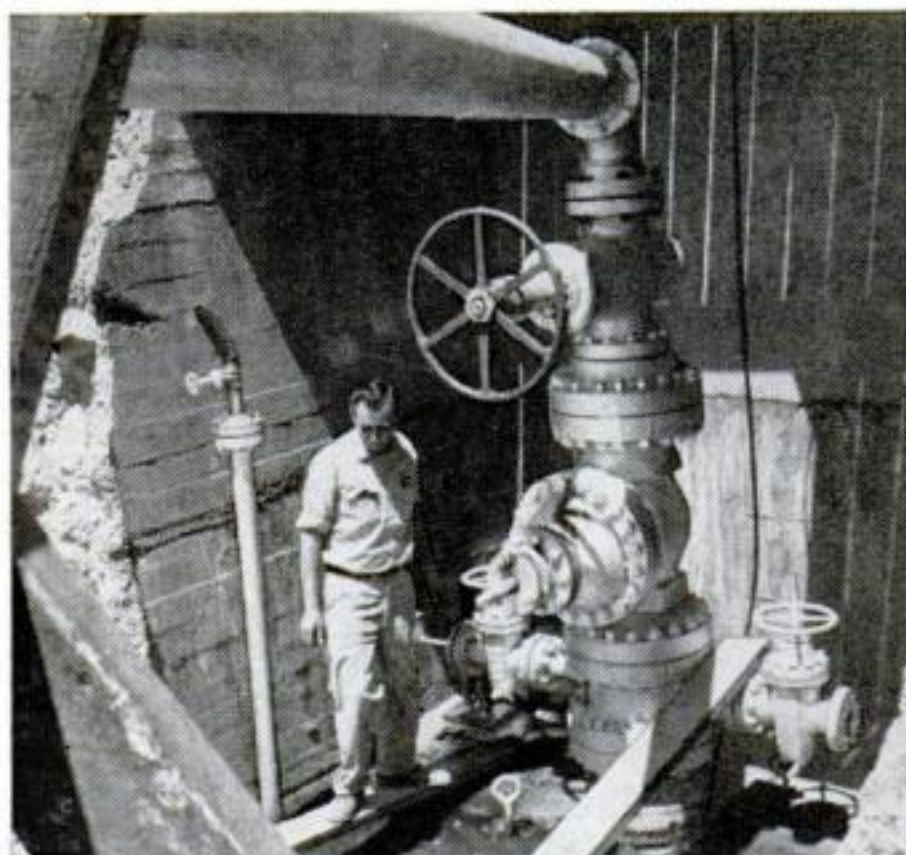


used for the generation of electricity. The geysers in the photograph above are on the Big Sulphur Creek site, north of San Francisco.

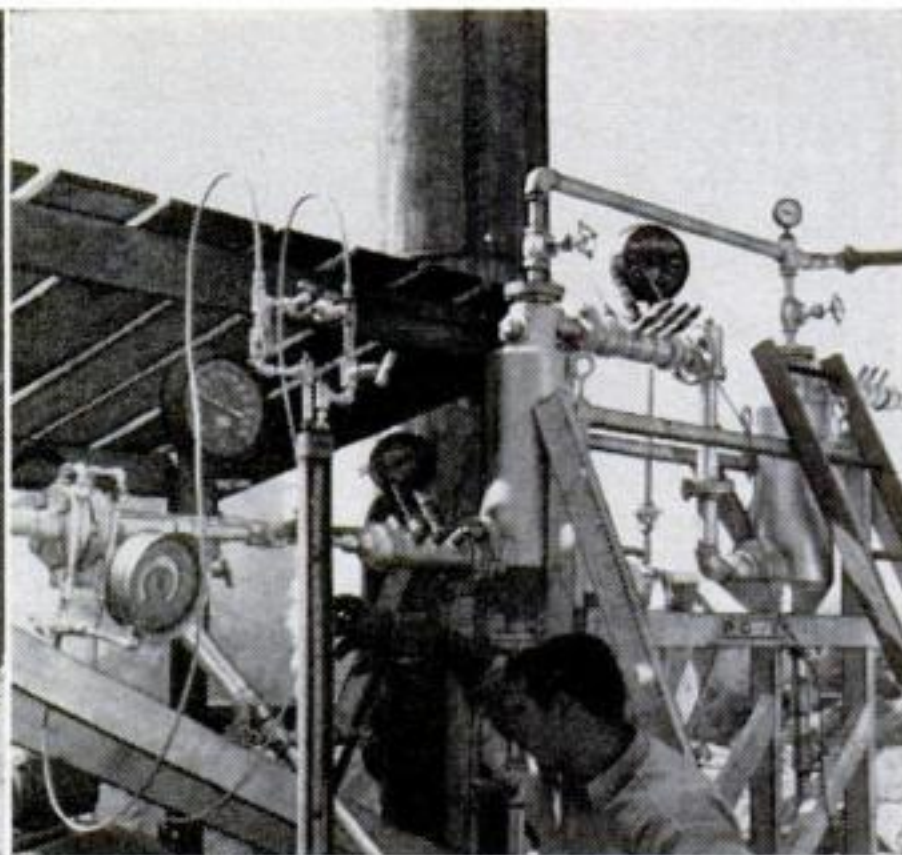


CLOSE-UP OF A GEYSER just after steam has been struck. Steam, gas, rock-and-dirt debris are jet-streamed high into the air.

CONTINUED



AFTER CAPPING, each well is tied into a horizontal trunk-line flow pipe. Insulated pipe maintains 348-degree steam temperature.



TESTING EQUIPMENT installed at a well head. Steam pressure, volume, corrosive quality, and amount of water, if any, can be checked.

generative capacity of 40,000 to 50,000 kw.

Only four acres of the possible power area have been tapped. The new wells haven't affected the pressure or capacity of the other wells nearby. In this "hot lands" country, four older Big Geyser wells have been blowing steam continuously for 30 years without slacking off.

Unlimited amounts of this kind of steam power exist—the whole inside of the earth is the source. However, there are only a few places where it can be tapped so readily.

The earth's crust is estimated to be about 20 miles thick. But in its shrinking and shifting, cracks form that let the superheated, molten inside—called "magma"—work up nearer the surface. Sometimes this hot stuff spills over and you have a volcano. Sometimes it only comes up near the surface, maybe 300-400 feet, as it does in this part of California.

Nature's steam plant at work. Steam is formed by the water—estimated at 10 percent—in the magma itself, and the water that works down from the surface of the earth to this hot core (estimated temperature of 3,000 degrees). The steam, under great pressure, works its way up through cracks in the earth's surface until it breaks through in steady spouts called "fumaroles." Hot springs and intermittent geysers like Yellowstone's Old Faithful are evidence of the earth's hot core getting near the surface. But only fumarole steam gives steady power that's usable.

The pilot plant under construction represents the first attempt to harness this kind of power in America. However, at Larderello, Italy, geothermal steam power is developing more than 250,000 kw. With current drilling and expansion, engineers estimate there's enough power to last at least 11,000 years.

Success down under. In Wairakei, New Zealand, 40 wells have been completed, harnessing more than 200,000 kw. of energy, which the government plans to use to power a new paper plant. Drilling programs for geothermal steam are now under way or are being considered in Mexico, Iceland, El Salvador, the Fiji Islands, and the British island of St. Lucia. There are other potential steam-power areas in California, and one well sunk near Reno, Nev., recently hit steam at 500 feet.

No boiler plant is needed for geothermal steam, saving an estimated 30 to 40 percent in the overall cost. In addition, boiler-plant maintenance is eliminated. Some geothermal steam is highly corrosive, but modern metal alloys have solved that problem. The steam wells of New Zealand bring up large quantities of water which must be filtered out before the steam can be sent into turbines. The steam at the Big Geysers in California comes up only moderately corrosive, is superheated, has only a little water. It is ready to turn a turbine with the opening of a valve.

New Ideas from the Inventors



Coil in Car Heats Camp Water. This recently patented heater would take the chill off an outdoor shower by routing water through coils draped over the ex-

haust manifold of the idling engine. A bypass would let you mix hot and cold. A fan-belt-driven pump could draw water, if necessary, from a lake or stream.

Flow Gauge Measures Boat Travel. You'd know how fast and how far your boat moved if you hooked on this indicator. A below-water impeller would spin at a rate proportional to the boat's travel. Through gears and a shaft, it would drive the dials of a speedometer-odometer.

Pan Collects Eraser Dust. Bits of rubber loosened when a typist erases a mistake wouldn't gum up a machine fitted with this dustpan. Lifting the eraser from a fitting on the sliding arm would cause a spring to move the pan up against the platen to catch falling particles.



More Inventors' Ideas



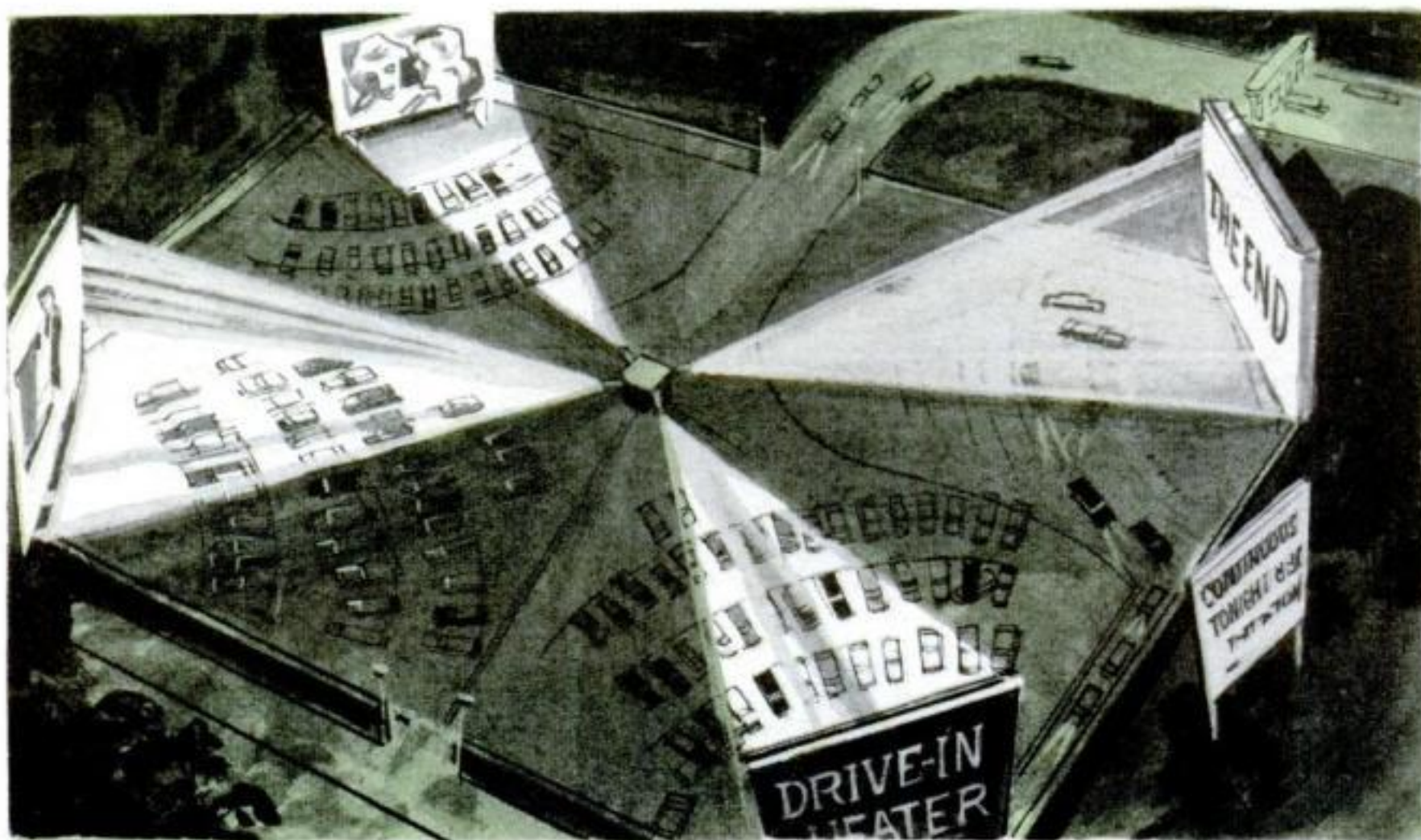
Foot Tool Spares Gardener's Back. You could snip weeds with an easy, no-stoop motion if you had a cutter like this fixed to your shoe. Several interchangeable tools designed to fit the strap-on holder would also simplify planting, cultivating, and similar gardening operations.



Car Runway Lets Pets Romp. If you take your cat or dog on car trips, you could give him freedom of the car by hooking this extensible runway over the front and rear seat backs. Moved to one side, the raised platform would also let him settle comfortably to watch the road.

Multiple Screens Stagger Shows. By clustering several "little" theaters—each with its own screen—around a central projection and service area, drive-ins

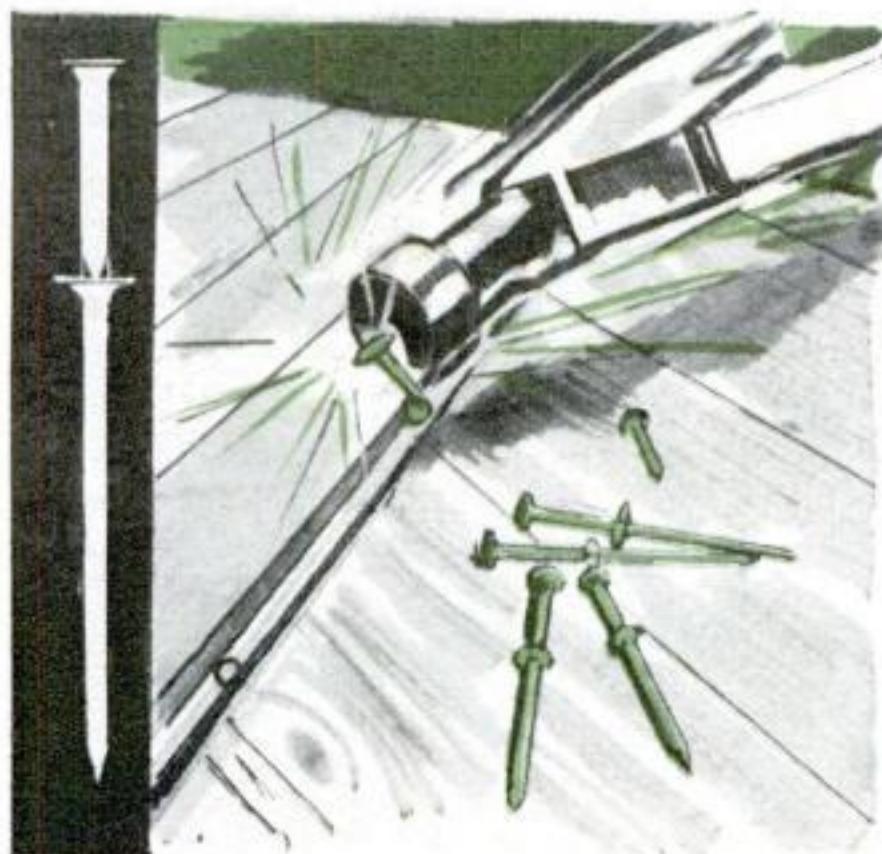
might ease the in-and-out traffic jams. To show the same program on all screens, reels could be moved successively from one projector to another.





Spark Timer Adjusts to Altitude. Air-pressure variations between mountain and sea-level roads affect the fuel-air mixture in a car engine's cylinders. To compensate—and thus minimize waste of gasoline—this pressure-sensitive bellows would advance or retard the spark.

Two-Headed Nail Protects Work. You could sink a nail completely without damaging the surrounding woodwork if it had a knock-off extension like this. Reinforced where the sections join, the nail wouldn't bend under glancing or off-center blows. But when the lower part was fully driven, a sharp side stroke would shear off the upper head and shank.



Roll Holder Rolls-On Wallpaper. You wouldn't have to wrestle with long sheets if you unrolled wallpaper from this applicator. A spreader would apply paste from a trough, one cutter would edge-trim the paper to proper width, and another would cut it off at top and bottom.

The following patents have been issued on these inventions:
Water heater—No. 2,894,265 to Paul Reardon, Torrance, Cal.;
Flow gauge—No. 2,773,383 to H. H. Kersten, Ft. Dodge, Iowa;
Typing pan—No. 2,795,310 to W. Siskind, Takoma Park, Md.;
Foot tool—No. 2,779,262 to B. and R. Furr, and M. Harrill Jr., Charlotte, N. C.;
Pet runway—No. 2,790,184 to S. Testa, Shreveport, La.;
Multiple screens—No. 2,895,179 to L. Wilson, Los Angeles;
Spark timer—No. 2,778,892 to A. G. Vanderpoel, Los Angeles;
Nail—No. 2,874,603 to W. Boettcher, Chicago;
Wallpaperer—No. 2,794,566 to R. M. Smith, Gastonia, N. C.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

Electrified Film Makes

HOW THERMOTAPE IS MADE

TV camera converts scene into electrical signal that controls electron gun of recorder

TV CAMERA



Electrons put ripples in plastic to make movies you can see at once—no processing needed

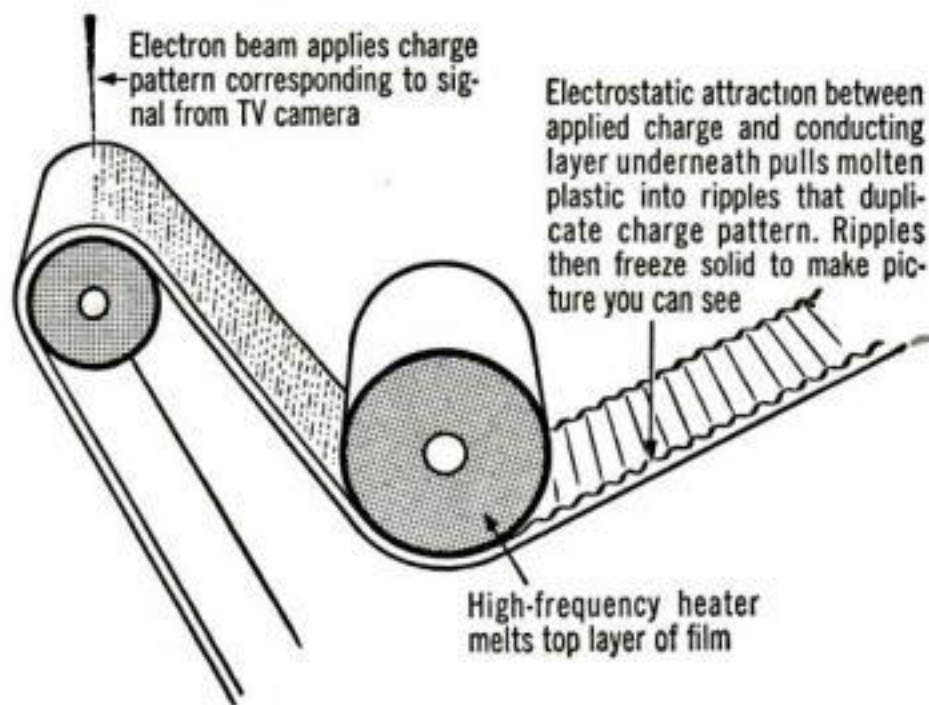
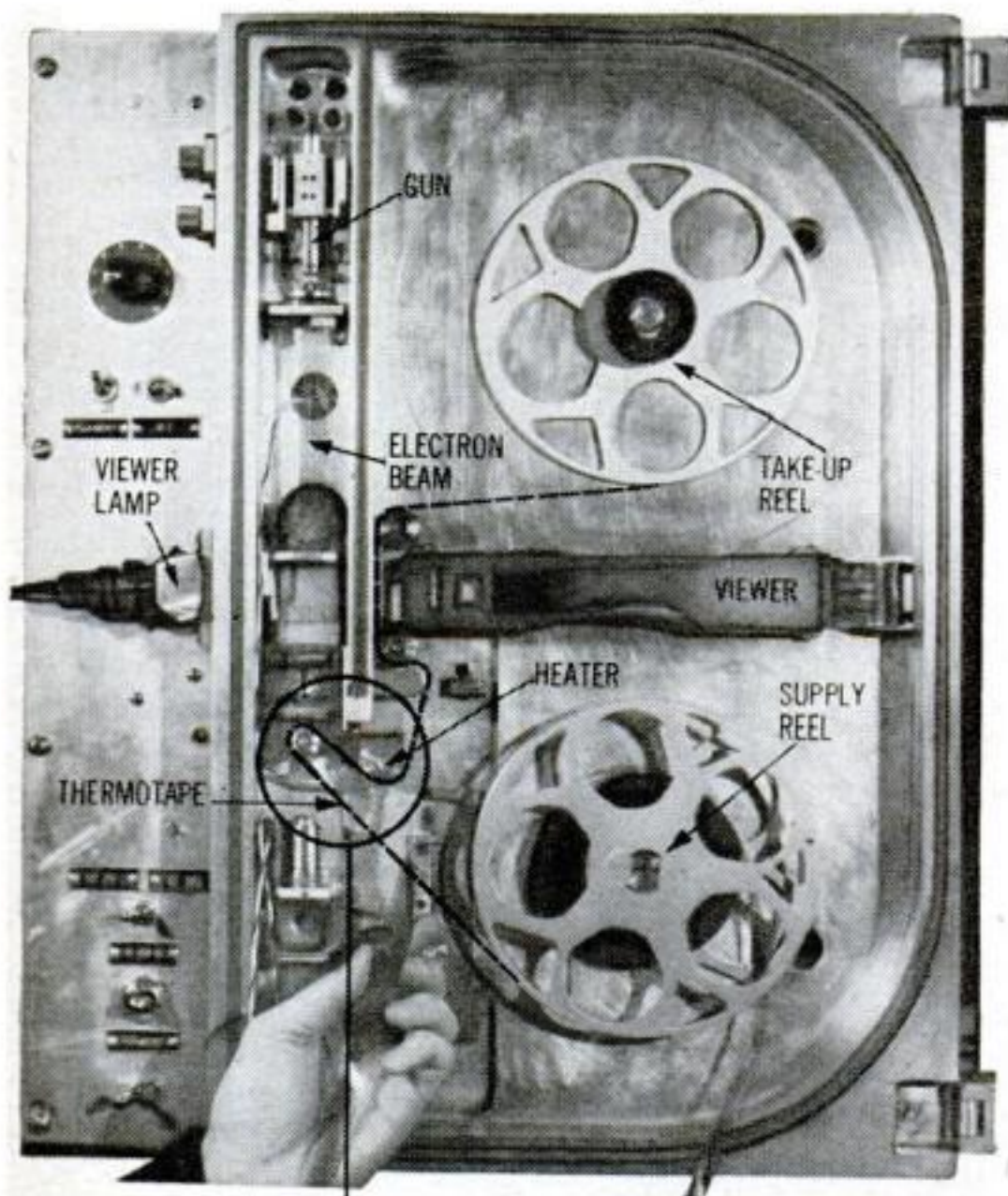
THE moguls of the silver screen (both TV and motion-picture divisions) are in a stew over a new movies-in-a-minute process that could revolutionize all kinds of picture-making, including your own production of homemade epics. It combines television and photography to turn out images you can see immediately, without developing. You'd be able to shoot baby's birthday party and project the scenes right afterward—no waiting for film to come back from the processing lab.

The new thermotape process, invented by General Electric's lanky, young (34) W. E. Glenn, engraves pictures on transparent plastic with electricity and heat.

The camera is a standard TV camera, its signal going to an electron gun like the one in a TV picture tube. The gun sprays a pattern of electric charge on the moving plastic tape. The tape then rolls over a heater, which melts the top layer of plastic. Electrostatic attraction between the charged pattern on the tape surface and a conducting layer underneath it pulls ripples into the molten plastic. It's the old "unlike charges attract" principle that you see at work when a comb pulls up dust particles.

By the time the tape rolls onto the take-up reel, it has cooled off and the picture ripples are frozen. An ordinary movie projector, just slightly modified, shows them.

Thermotape's big advantage over photography is the way it ducks chemical processing. It beats magnetic-tape recording



Movies in a Minute

(which also eliminates processing) with its ability to capture fine detail—length for length, thermotape records about 200 times as much information as magnetic tape. Theoretically, thermotape pictures should be as sharp as photographs.

But there are also other selling points:

- It records color (the electron beam splits to engrave diffraction gratings for each primary color; on projection, the gratings recombine light to make one full-color picture).

- It takes still pictures—transparent slides—in black-and-white or color.

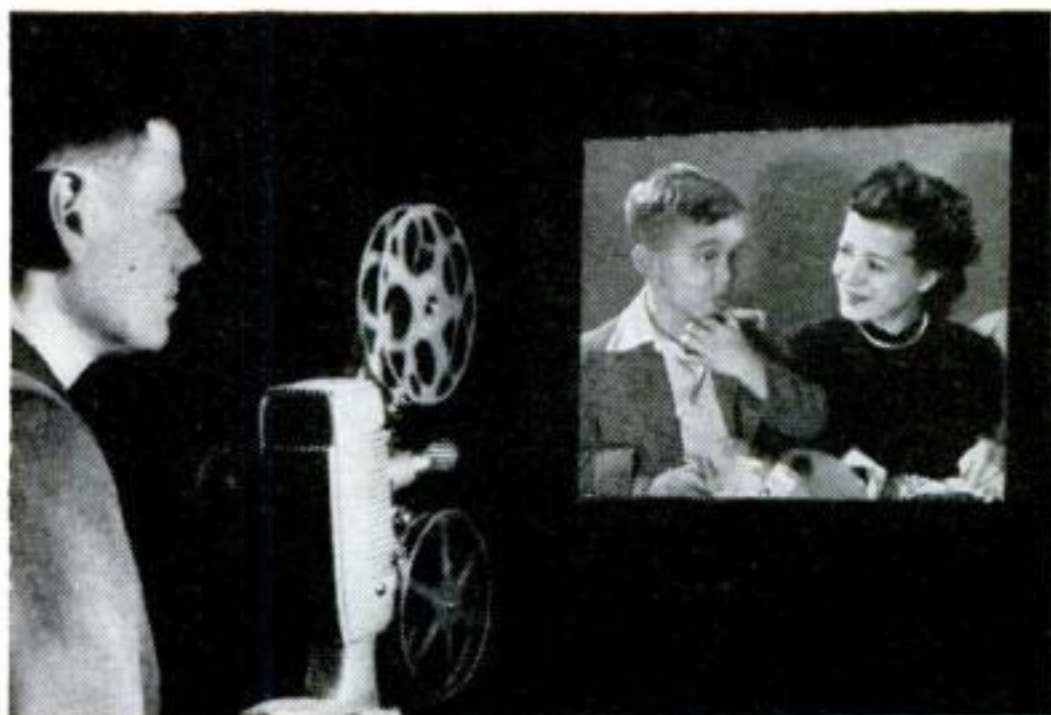
- It records any kind of electrical signal: pictures from a camera tube, sound from a microphone, or information bits from an automatic computer.

- The tape can be duplicated by stamping, the same as phonograph records. Its picture ripples are real, material ripples, like the wiggles in a phonograph-record groove. Potentially, stamping is a much cheaper method than photographic printing or magnetic tape re-recording, and could lead to inexpensive copies of Hollywood movies for home showing, or better hi-fi systems (one small reel of thermotape can carry 100 symphonies).

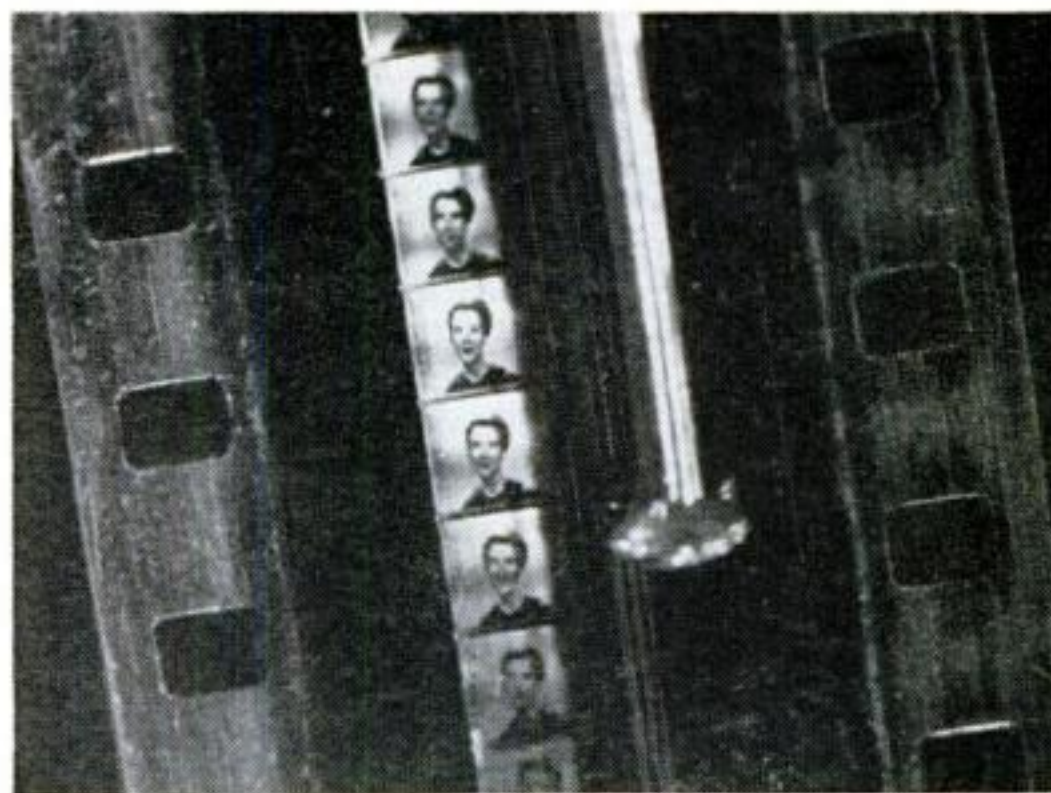
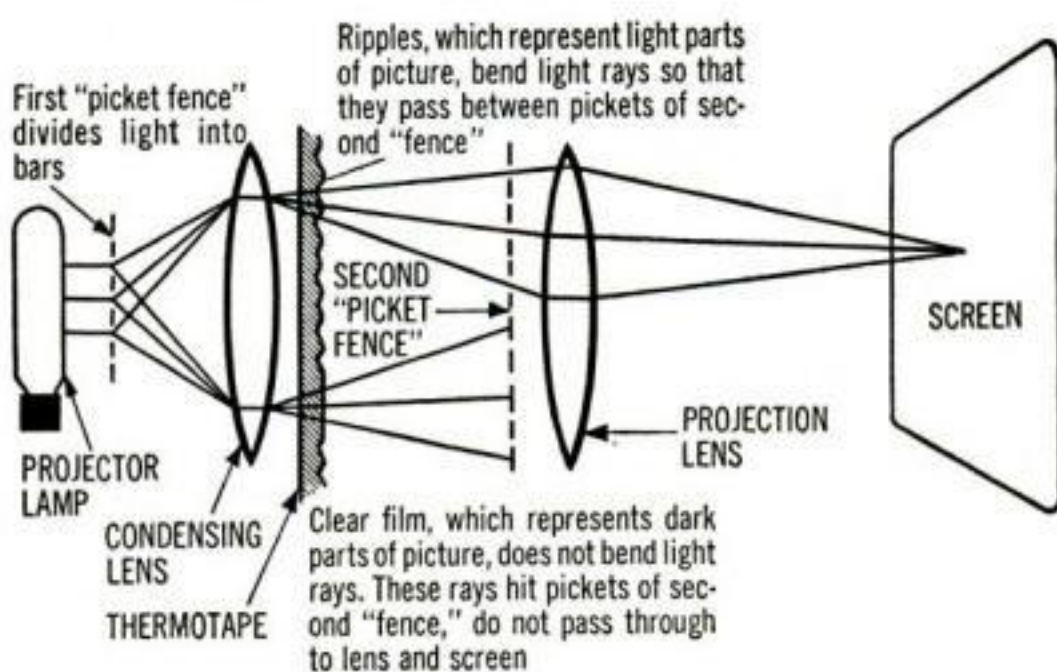
- The tape can be erased and used over again many times (you just heat it; the plastic melts and the ripples smooth out).

First uses of thermotape will be to provide the memory for electronic computers, and to take pictures from satellites. General Electric demonstrated laboratory rigs that worked surprisingly well, and offered to deliver a complete unit to the armed forces before the end of the year, but refused to guess when—or if—it might make home-movie outfits.

HOW THERMOTAPE IS PROJECTED



INVENTOR GLENN projects thermotape pictures in 16-mm. movie machine (notice "picket fence" ahead of lens).

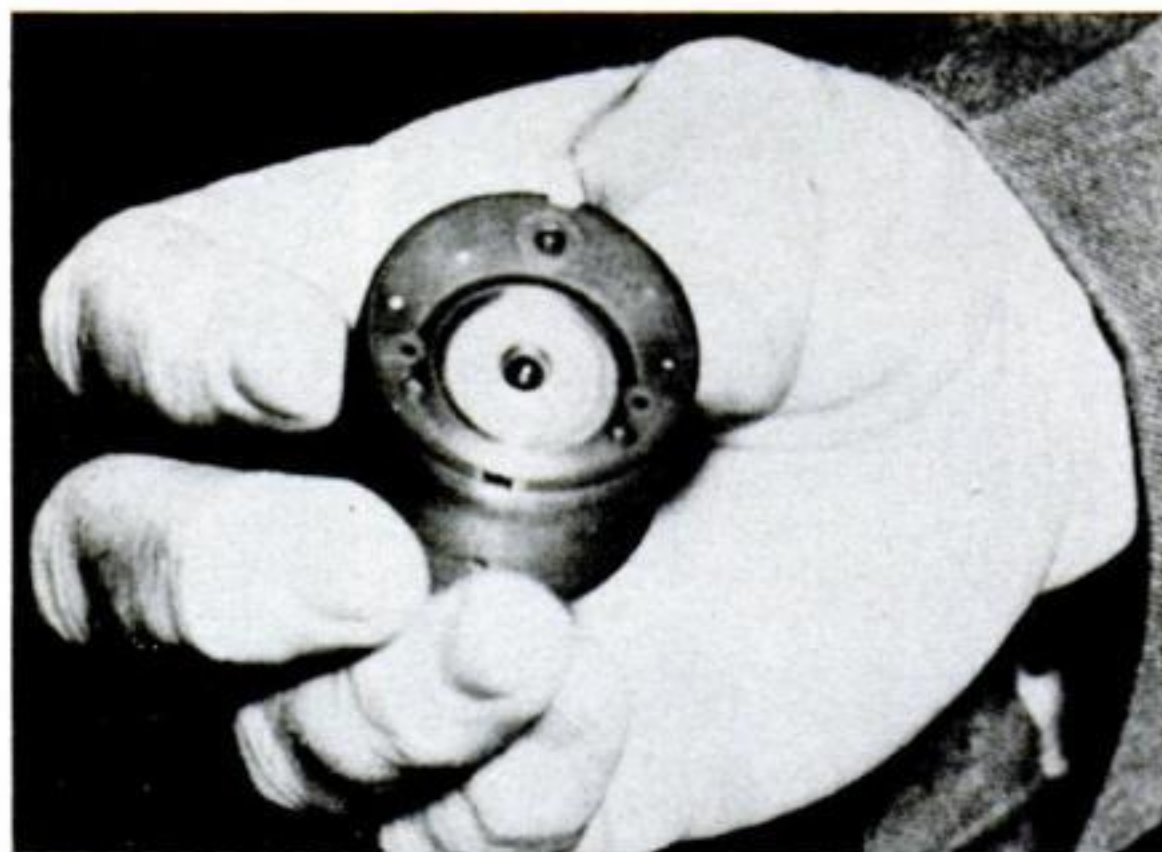


THERMOTAPE PICTURES are 1/10-inch square (that's a common pin next to them), but can be other sizes. Plastic film used here is 16 mm. wide, to fit standard projectors.



Three-wheel fork lift

Kid brother of some of the huge road and forest machinery built by R. G. LeTourneau, Longview, Tex., this "midget" fork lift will hoist and carry 17 tons. It has only three wheels—the two in front housing electric motors geared to their inner rims, and the single one at rear swiveled for negotiating turns.



Riding high on head of bed

Residents of Walla Walla, Wash., look up to this Whitman College sophomore as he pedals around town on the bicycle he built from an old bedstead. He climbs a tree to mount the strange contraption, dismounts with a wide, sweeping jump.



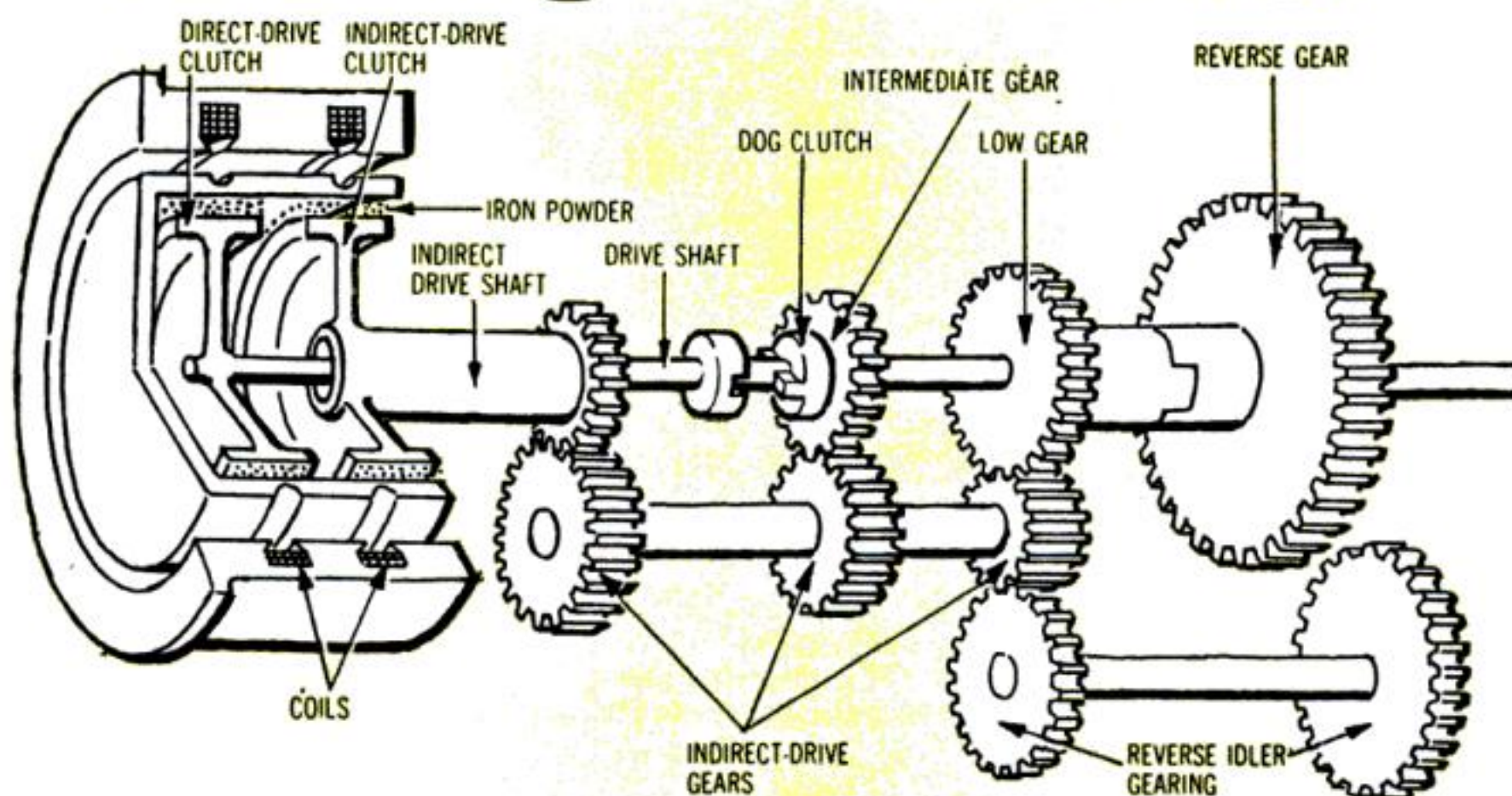
Missile camera is one-shot midget

The tiny camera at left was developed in Australia to be carried in practice guided missiles. It takes a wide-angle shot of the near-in target to show the missile's angle of approach.

It has a 186-degree field, and the lens can be aimed to include a horizon line or ground features that will aid in later study.

About one in three of the cameras is recovered for re-use with minor repairs.

New Automatic Shift Uses Magnetic Clutches



A MODIFIED MANUAL GEARBOX provides torque in the Rootes transmission. It lacks

the hydraulic torque converters and planetary gearsets used in U. S. automatic drives.

This import from Britain locks up solidly in high gear for the maximum in gasoline economy

By Devon Francis



IT WAS only a matter of time until one of the low-priced little foreign cars would come breezing across the Atlantic with an automatic transmission tucked away in its innards. Now it has happened. Rootes Motors—who produce, among other automobiles, the veddy, veddy British Hillman—has announced a no-hands drive.

This transmission is like nothing whatsoever produced in the U. S. Domestic automatic drives are mechanical and hydraulic. That goes for the gear-changing Hydra-Matic as well as for the various brands of torque converters backed up by automatic gears.

The Rootes automatic drive, called Easidrive and priced at \$199, is just as automatic as its American counterparts,

but it works electrically. Oddly enough, it's based on an American invention.

How it drives. Controls on the Rootes system are similar to those in U. S. cars. There is, of course, no clutch pedal. The selector quadrant reads: D 2 N R. D, N, and R are readily interpretable. When the selector is on 2, high and low gears are locked out for engine braking on downgrades.

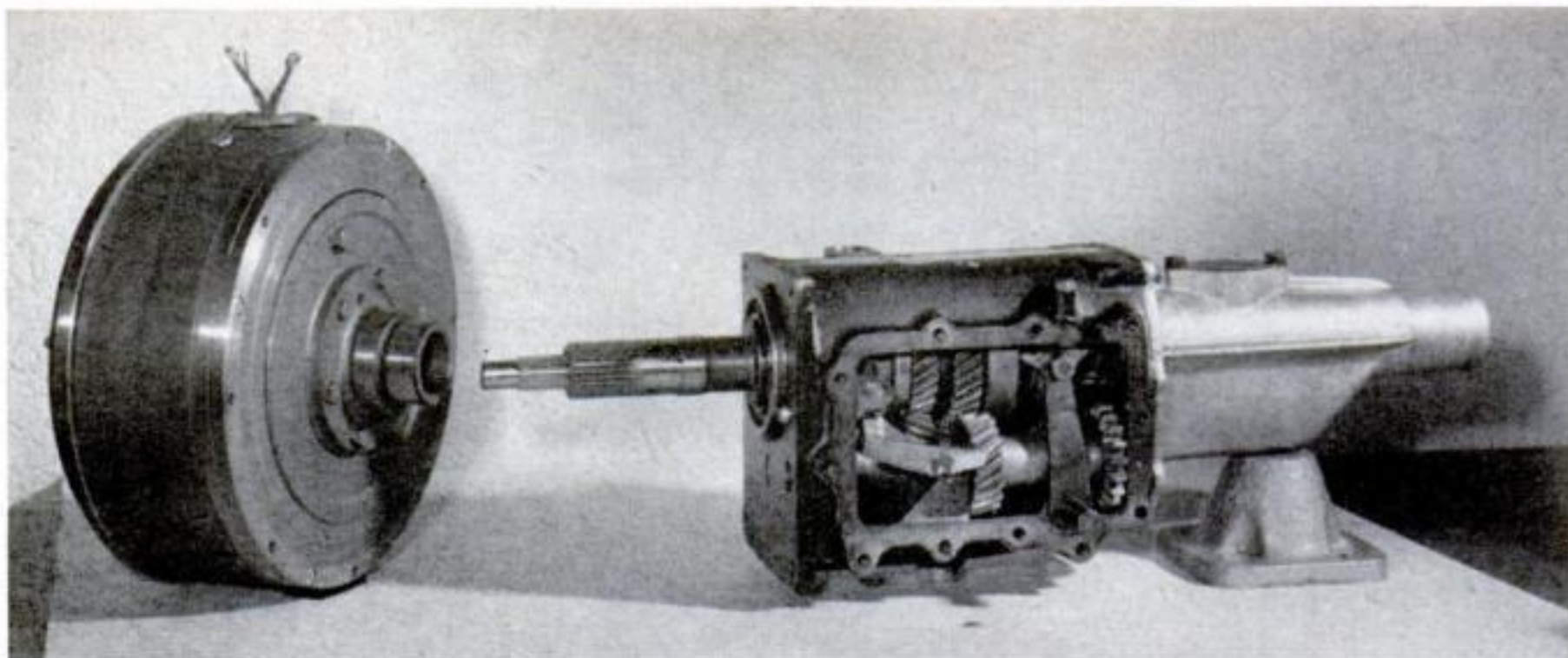
Seated in a Hillman Minx, fire up and slip the lever into D. Depress the accelerator. It takes quite a bit of push before anything happens. This is deliberate. The electrical contacts are quite a distance down the pedal travel so that everything is disengaged at zero pedal pressure. That eliminates creep at stop lights.

The car moves away smoothly. Depending on accelerator position, the transmission upshifts from low to second between 11 and 22 miles an hour, from second to high between 22 and 46.

The transitions between gears are like silk, both going up and coming back down. The accelerator produces the demand downshift into intermediate or low for added torque. Just tromp on it. Under

CONTINUED

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MAGNETIC-COUPPLING HOUSING (left) is 5½ inches thick and 11½ in diameter. Behind it is

gearbox with two splined shafts, one inside the other, for geared and indirect drives.

pedal pressure, the transmission backs down into second at speeds below 45 and into low under 18 m.p.h.

Aside from the fact that the busy little Hillman engine, loaded with 40 pounds of car for each horsepower, is somewhat overburdened for a three-speed box, the car has a thoroughly familiar feel.

But there's one significant difference—once you're in high gear, the power train from engine to rear wheels is locked up tighter than a drumhead. The "slip" that is characteristic of American automatic transmissions at moderate speeds is missing. Result: better gas mileage.

How it works. The heart of the Rootes drive is a magnetic clutch—more properly, a coupling—invented years ago by Jacob Rabinow of the U. S. Bureau of

Standards. It substitutes for a pedal-operated friction clutch. Rabinow made a clutch of powdered iron suspended in oil. When he introduced an electrical field into it, the iron "froze." It locked up.

His invention has been used since in calculators and military control systems.

Six years ago the Eaton Manufacturing Co., of Cleveland, experimentally introduced the Rabinow magnetic clutch in an automobile. This was described in **POPULAR SCIENCE** in March, 1954.

To keep the record straight at this point: The Rabinow-type clutch has no resemblance to the magnetically operated friction clutches now available on some European cars. Such clutches—the Ferlec, for instance, on the Renault—are ordinary clutches with electromagnetic controls.

The Rabinow-type clutch is, however, available in the Peugeot.

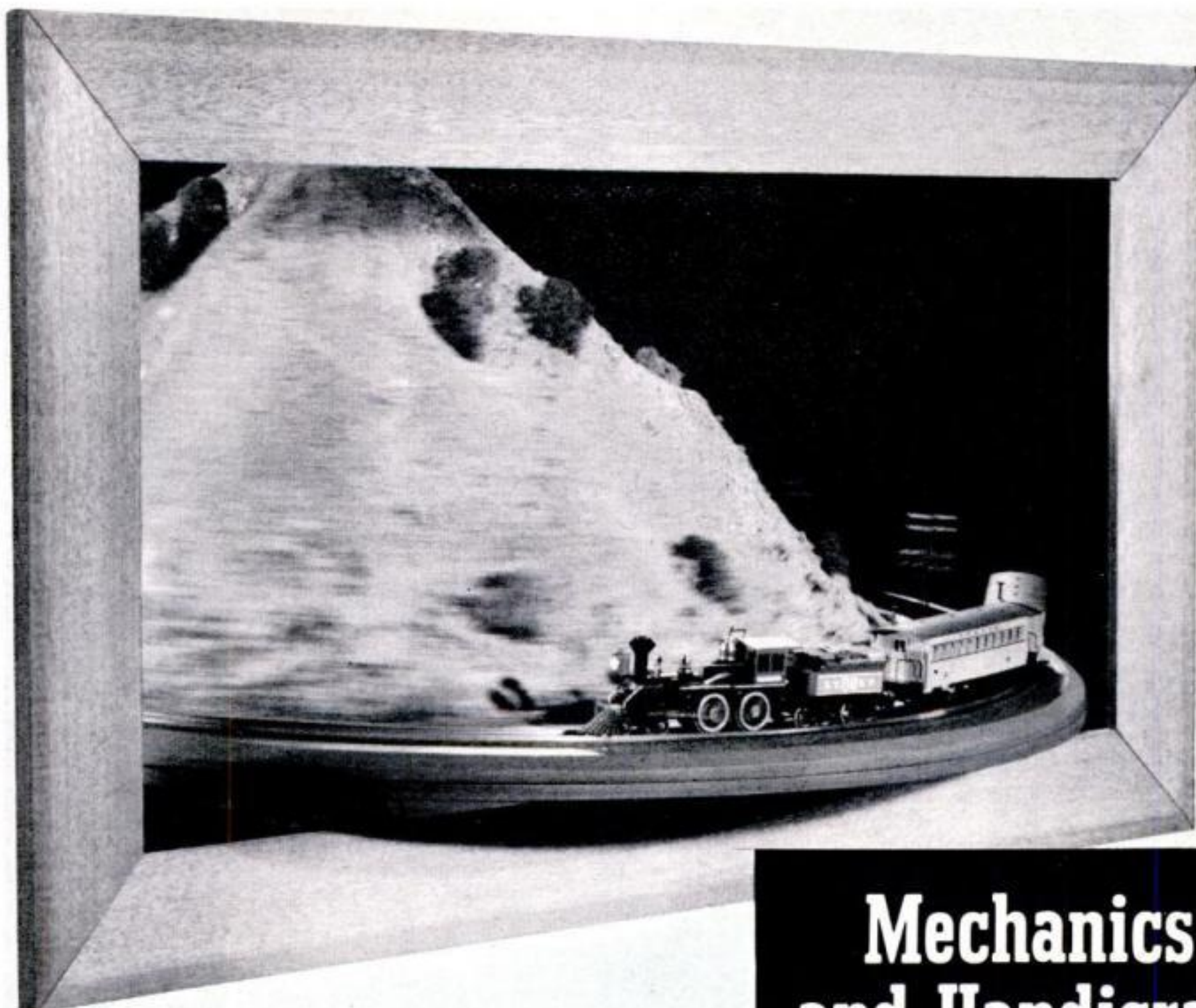
The Rootes system uses iron powder like the Rabinow, but without the oil. The dry powder lies in a receptacle around the engine crankshaft. When coils introduce an electrical field to the powder, the powder freezes the engine crankshaft to the car's drive train.

Electrical sleight-of-hand. So far, so good. But automatic transmissions have to be more than magnetic clutches. They must multiply torque through converters and/or gears. They must have "brains"—control systems—to upshift and downshift. They must respond to hard accelerator pressure by delaying upshifts, or by downshifting, for more torque.

[Continued on page 226]



TWO PACKETS OF IRON POWDER, each weighing two ounces, "lock up" the magnetic clutches. Sized and shaped precisely, the powder particles need replacement only after 60,000 miles.



It's full speed ahead on a 30-inch circle! Here's how to set up, and run, a prize model on a Lazy Susan

Mechanics and Handicraft SECTION

The Speeding Train That Goes Nowhere

By Carlton J. Bucher

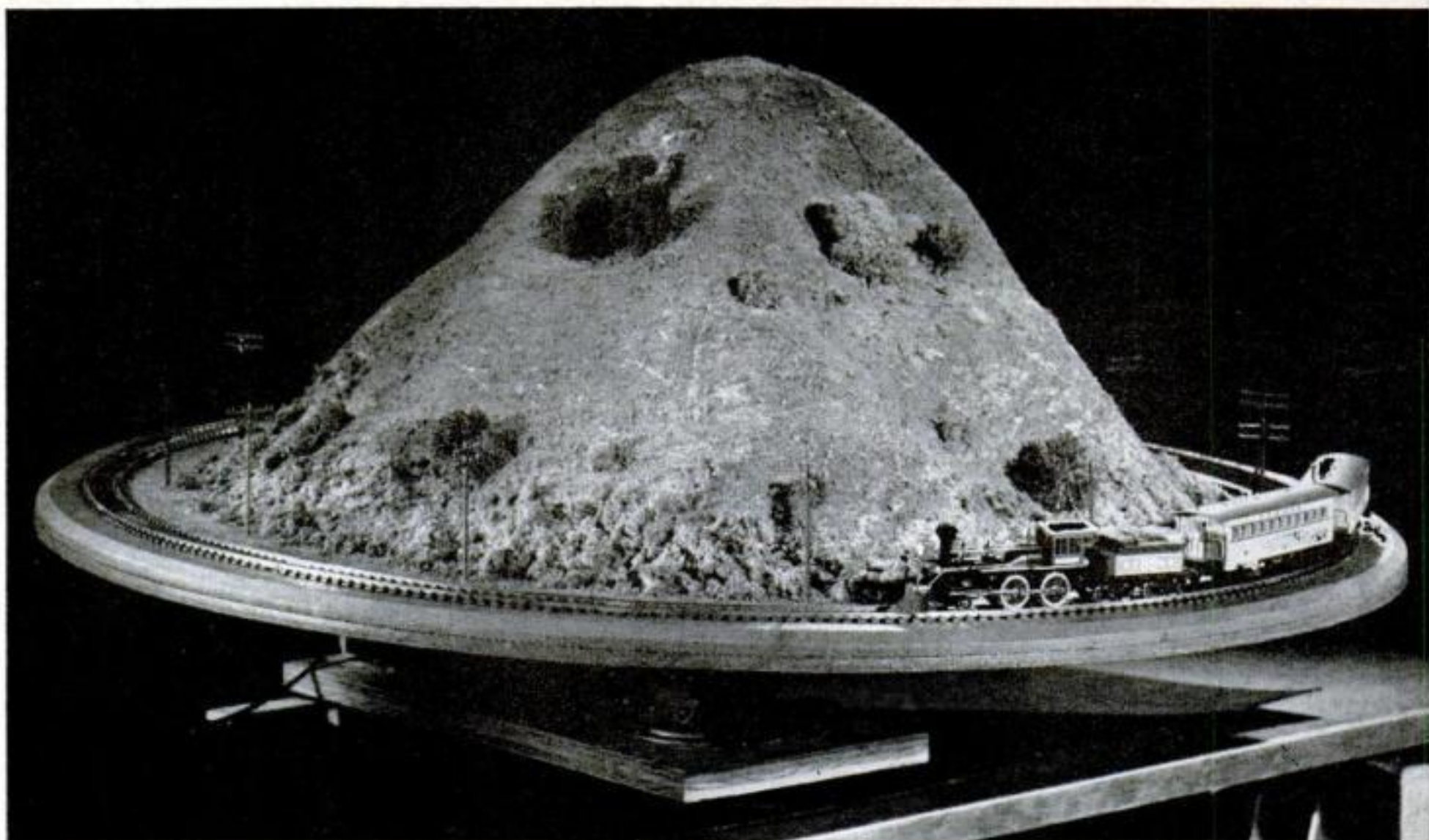
THE little train above is running at full throttle—and getting nowhere. It's trying to climb the slight incline of a tilted circle of track, but it will never make it for two reasons: 1) gravity is holding it at the low side of the incline; 2) the track is mounted on a smooth-working turntable. The locomotive's spinning drivers can only kick the track beneath it, the way a donkey moves

a treadmill when it pushes against a fixed yoke.

But save your tears of pity. That energy is far from wasted. It puts the train in a position in which it can be observed in a very unusual way. You see the locomotive racing along like one in the movies—drivers pounding furiously, side rods and valve gear a blur of motion, landscape flashing by at what seems to be 100 m.p.h. Viewing it close up, you see engine and cars swaying from side to

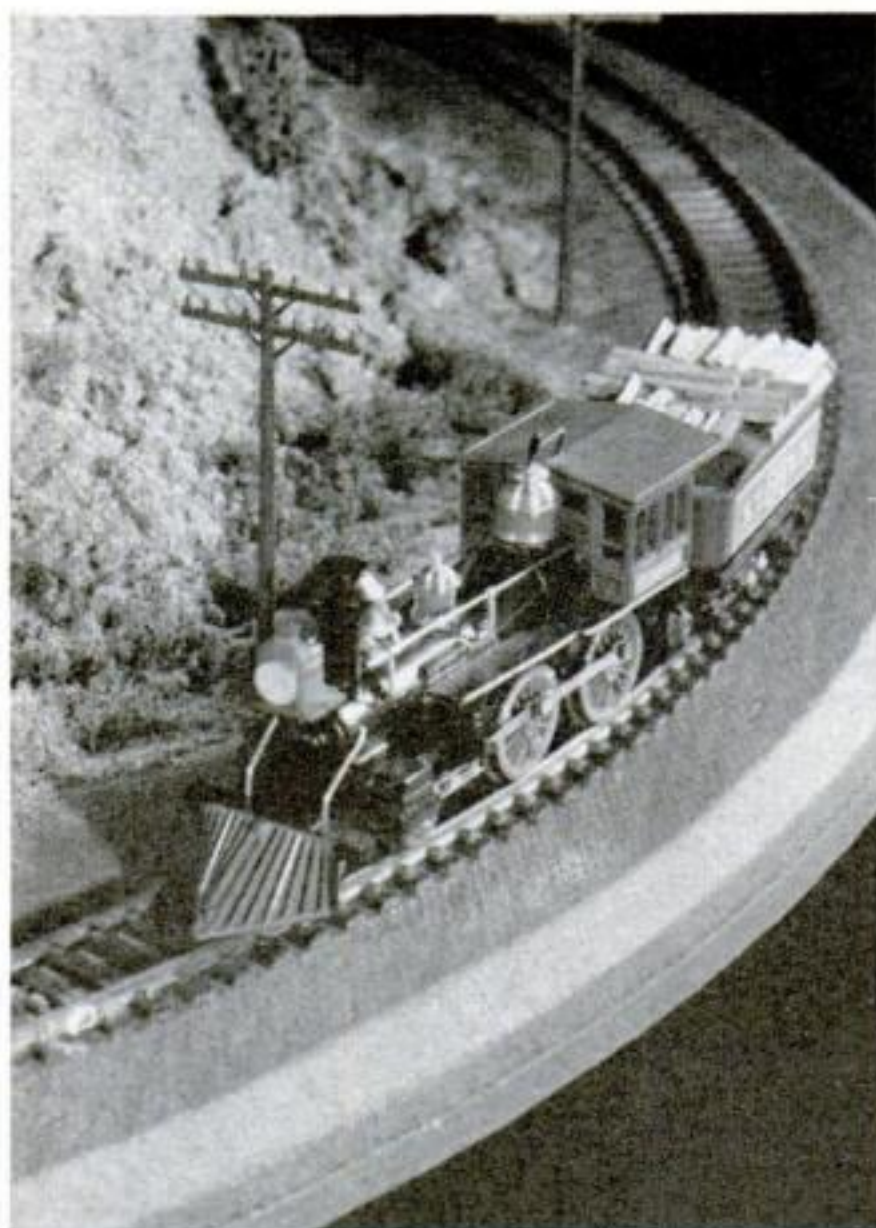
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LAYOUT IS BUILT ON A BICYCLE WHEEL to make a perfectly balanced turntable. One end of the base is elevated on two bolts to give the table a slight tilt. Gravity causes the train to swing

around to the low side of the incline. When power is applied, the locomotive's spinning drivers make the table rotate beneath it at a rate proportionate to the train's speed.



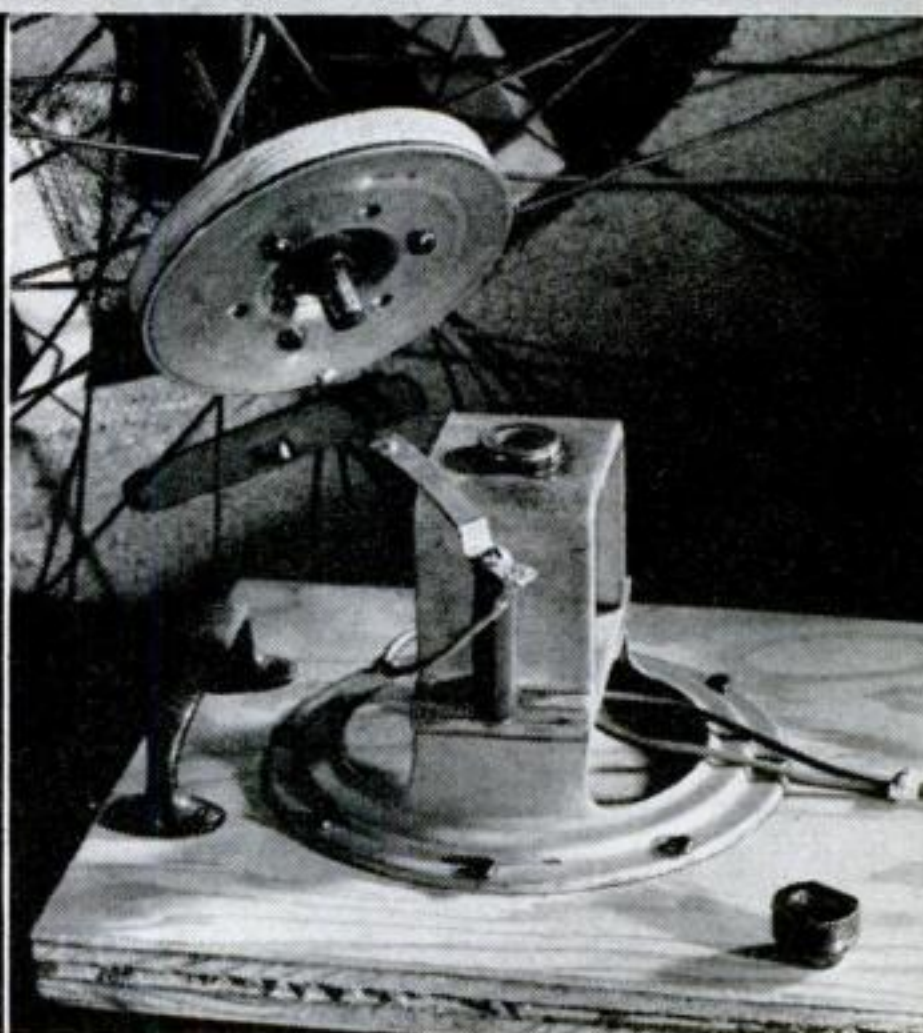
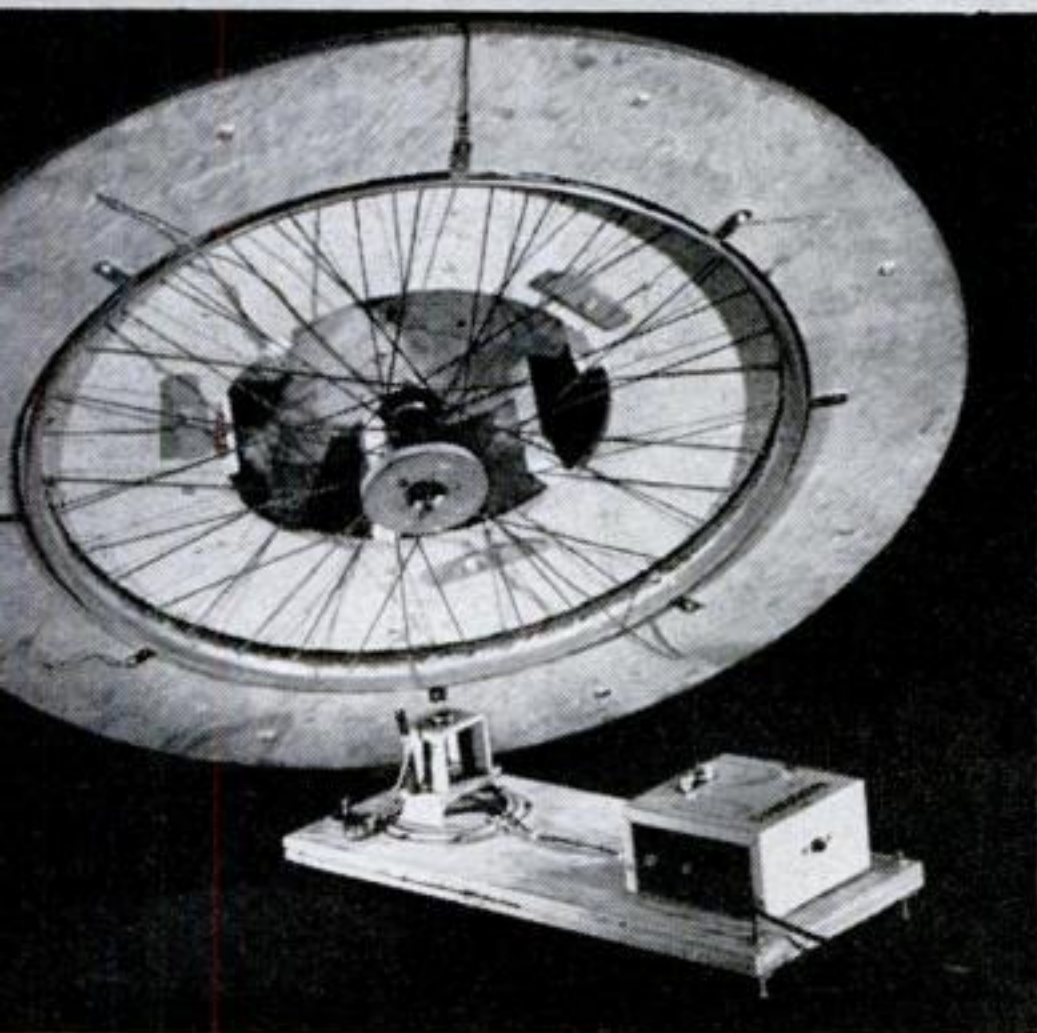
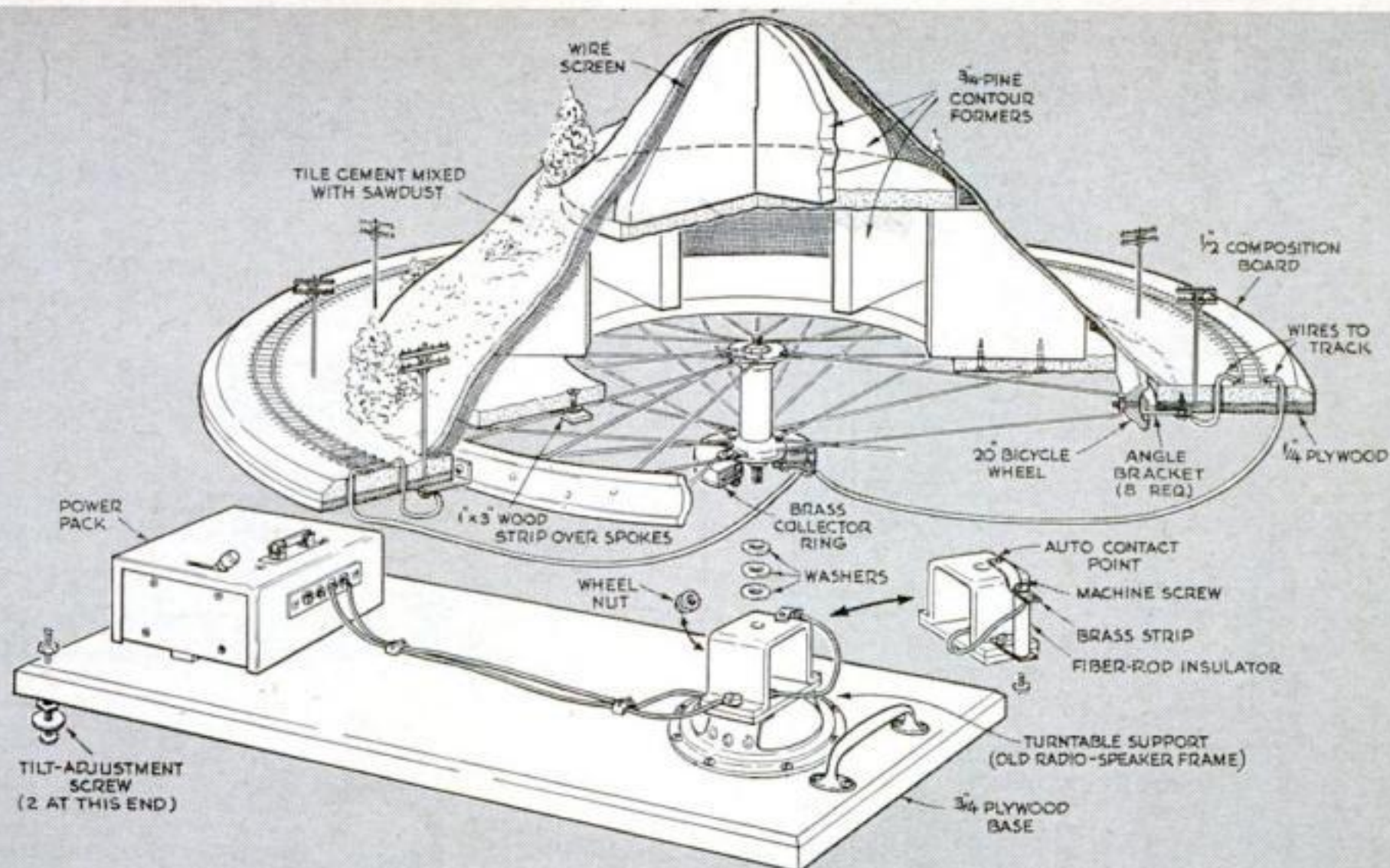
SCENERY DETAILS include evenly spaced telephone poles, shrubs and trees made of modeler's lichen or sponge, and flock for grass. Track is laid on composition board painted gray.

side, and there's a wonderful illusion of miles being traveled. It is a startling display that can be used as:

- A permanent conversation piece in a playroom.
- A setup to operate Christmas trains all year round in limited space.
- A store-window eye-catcher to attract passers-by.
- A proving ground for serious model railroaders to test new equipment. (You can run full throttle without fear of derailment, because no centrifugal force is exerted on the train.)

The framed setup shown on the preceding page is ideal for a playroom having one wall adjacent to a closet or utility room. You simply cut an opening in that wall and build a box on the opposite side to house your railroad. There are countless opportunities for dramatic effects such as lighting separately controlled to change from day to night while the train travels its endless miles.

To build the layout, you start with a bike wheel and a ring of $\frac{1}{4}$ " plywood for the roadbed. Cut the outside diameter of the ring about 2" wider than the circle of track you're using, and cut the hole



CURRENT GETS TO TRACK through ignition point (photo at right), which rubs collector ring to make one side of circuit. Other leg is soldered to axle support, and current flows through the

bearing. Wires under turntable connect track to wheel and collector ring. Photo at left and cutaway of turntable and mountain (top of page) show construction details.

for a snug fit around the wheel. Fasten the plywood to the wheel with small angle brackets. For quiet operation, cover the plywood with a ring of 1/2" composition board such as Celotex or Homosote. Build up the contour of the mountain with formers cut from pine and covered with wire screening. There are many materials

suitable for surfacing the landscape, but ordinary linoleum cement mixed with fine sawdust was used for the model shown. Fasten the track in position and drill evenly spaced holes for telephone poles. Note: If track is screwed down, use short screws into the composition board only. If long screws are driven through and

Any store owner can make use of the train's eye-catching appeal



DISPLAY STAND in place of the mountain can be made to rotate by the train, attracting the attention of passers-by. Arrange display merchandise so the turntable remains balanced.

into the plywood, they will transmit track noises.

Current is carried to the rails through the wheel and through a brass collector ring mounted on the hub. Insulate the collector ring by mounting it on a ring of plywood fastened to the hub. Connect one power-pack wire to the wheel axle, the other to an auto ignition point soldered to a strip of spring brass. Fasten the brass strip to the pivot support and bend it to make firm contact against the collector ring. An old radio speaker frame was used for the support shown, but a piece of strap iron or aluminum can be drilled for the wheel axle and screwed to a block of wood.

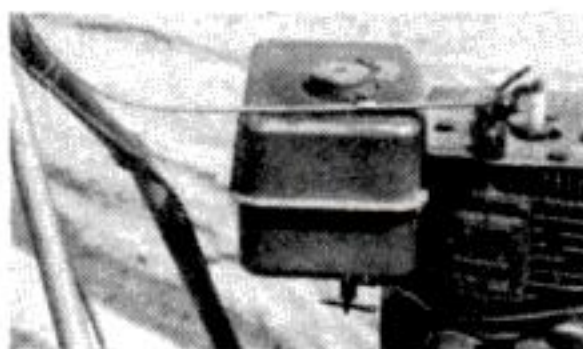
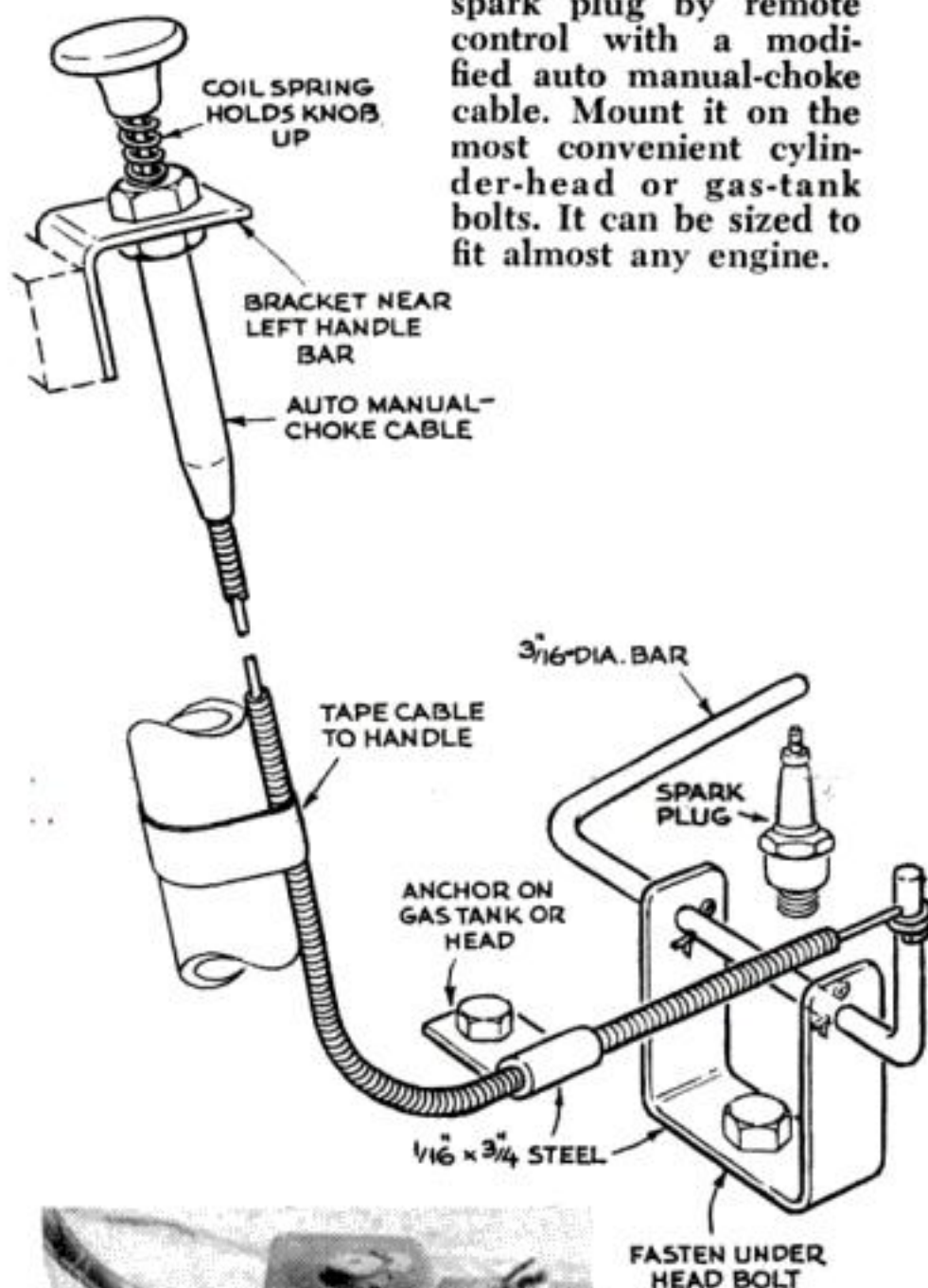
Mount the pivot support and power pack on a plywood base and drill holes in one end for two tilt-adjustment bolts. When the train table is placed in operating position, back off the adjustment bolts to raise one end of the base until the table has sufficient tilt to rotate easily under the weight of the moving train.

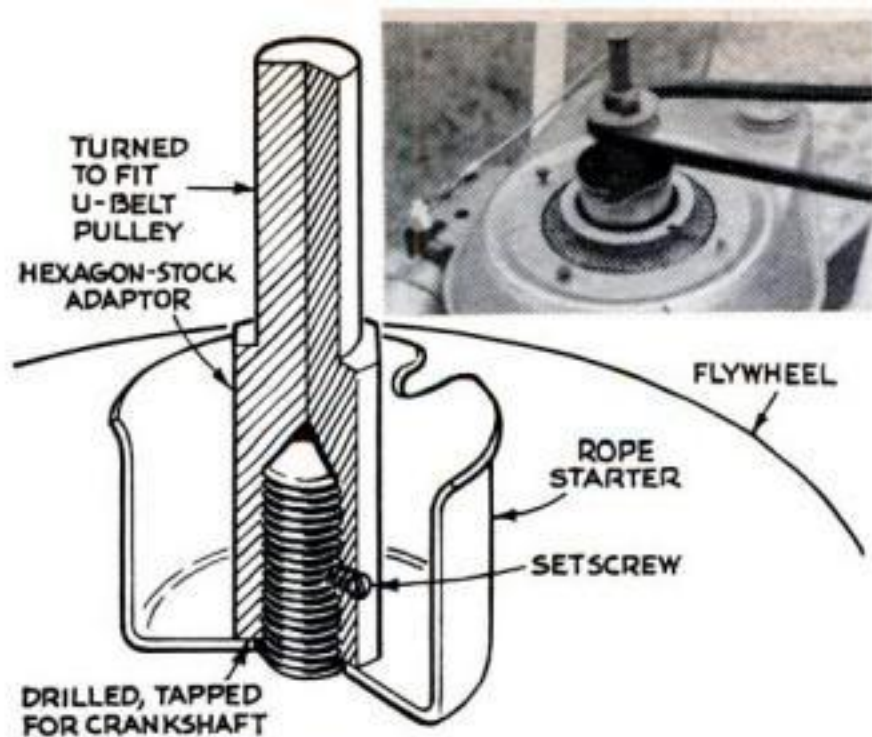
The speeding train that goes nowhere makes an attractive store-window display. For this, build up a stepped table in place of the mountain. Arrange the merchandise on the table with the train off the track, and rotate the table to be sure the items balance each other. Don't try to display heavy items: They'll throw the turntable out of balance.

7 Hints for Better Power Mowing

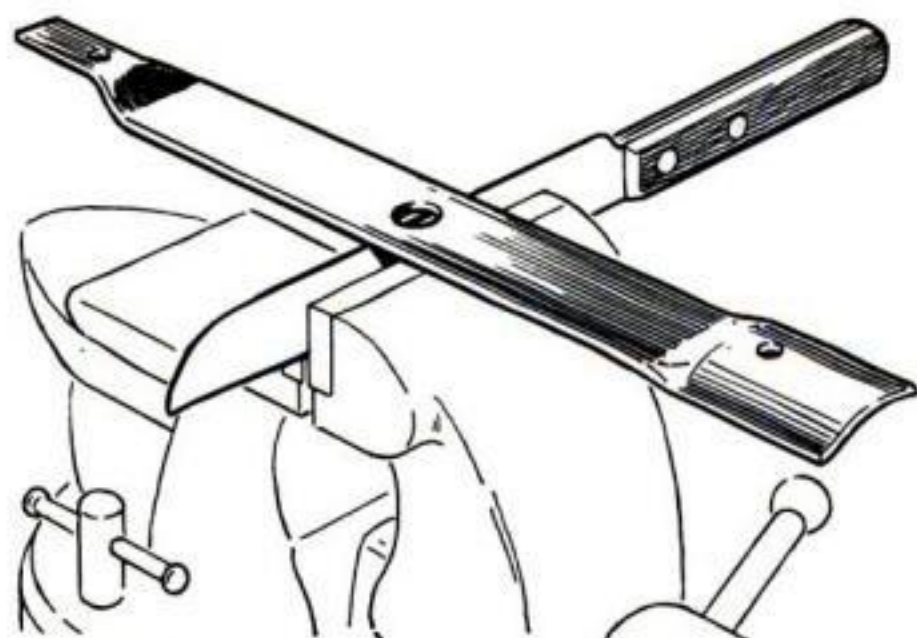
PUSHBUTTON SHUT-OFF:

You can ground the spark plug by remote control with a modified auto manual-choke cable. Mount it on the most convenient cylinder-head or gas-tank bolts. It can be sized to fit almost any engine.





ADD A POWER TAKE-OFF and you can use your mower on other jobs. Replace the flywheel nut with this adaptor you can make from hexagon stock. Turn one end to fit a V-belt pulley and drill and tap the other end to fit the crank. You may have to replace a rewind starter with a rope-starter pulley.



BALANCE THE BLADE on a knife edge when you sharpen it. Regrind or file the heavier end until the blade rests level. Hold the knife erect in a vise or with brads in a board. To save time centering the mower blade on the knife, scribe a permanent guide line across the true center of the blade.



A BIG TIN CAN will give you a place to put the trash you pick up each time you cut the grass. Punch a hole in the bottom of a big coffee can and clamp it under the wingnut holding the top of the air cleaner.



SHIELDS give you an easy-to-trim outline around your trees. Grass won't grow beneath circles cut from asphalt-saturated building felt.

TIRE CRACKED? Until you can replace it, keep it round with rubber bands. Cut inner-tube slices slightly wider than the tire; they'll grip snugly and stay in place.

KEEP YOUR GAS CAP on a leash—you can't misplace it. Bolt a length of light chain to a nut soldered to the cap. But be careful that you don't clog the air-vent hole.



Wall Rack for Kitchenware

HANGING a pan on a perforated-hardboard hanger is no problem. But what about the lid that refuses to stay put? After it's jarred the nerves a few times with its cymbal-like crashes, it gets tucked in a cabinet drawer, inconveniently far from its mate.

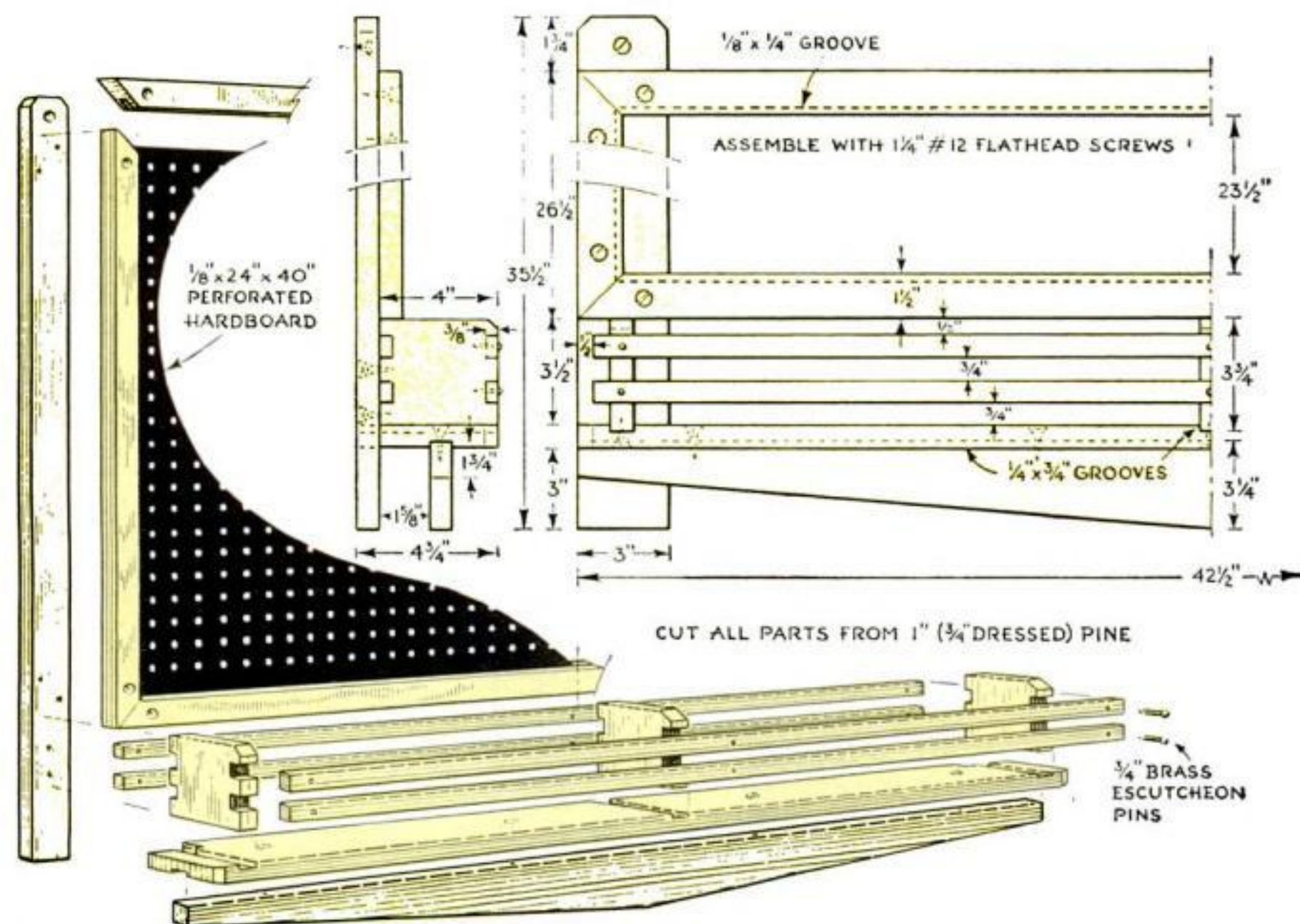
There's no such problem with this kitchenware wall holder. It has a 4"-

by-40" shelf for skillet and pot lids, with dividers and slats to prevent rolling. There's plenty of fenced-in space left for salt and pepper shakers and a couple of spice jars.

Start construction by cutting the perforated-hardboard panel to size and applying two coats of kitchen-harmonizing, semigloss enamel. While the paint is drying, sand the framing parts. Two 7' lengths of one-by-eight pine will give you all the $\frac{3}{4}$ " dressed material you need for the job.

Assemble the holder with the panel in place, using glue, flathead screws, and, in the case of the shelf slats, escutcheon pins. Drive the pins through predrilled holes to prevent splitting the wood. When you countersink the screw holes, make them deep enough to accommodate head-hiding plugs of wood putty. A couple of coats of varnish on the frame completes the project.—*Henry B. Comstock.*

PAN-AND-COVER CADDY can be screwed to paneled walls only; use sturdy expansion anchors for fastening on other walls. Or change dimensions to fit studs and use long screws.



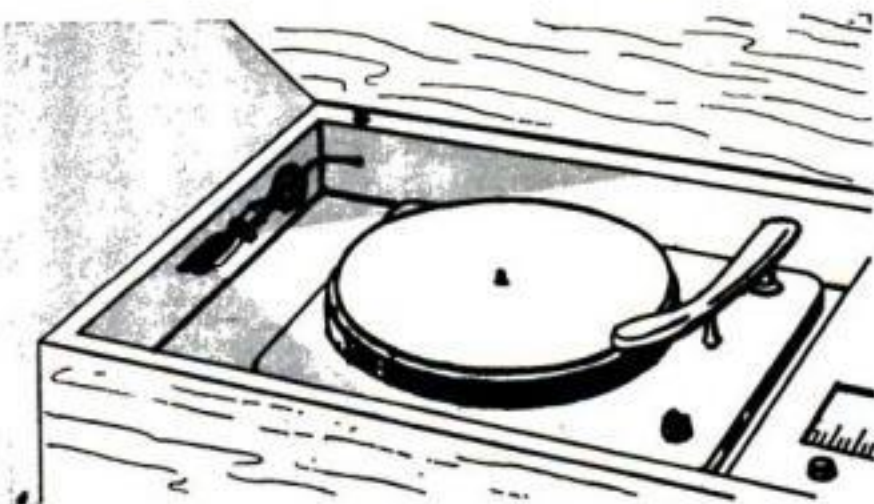
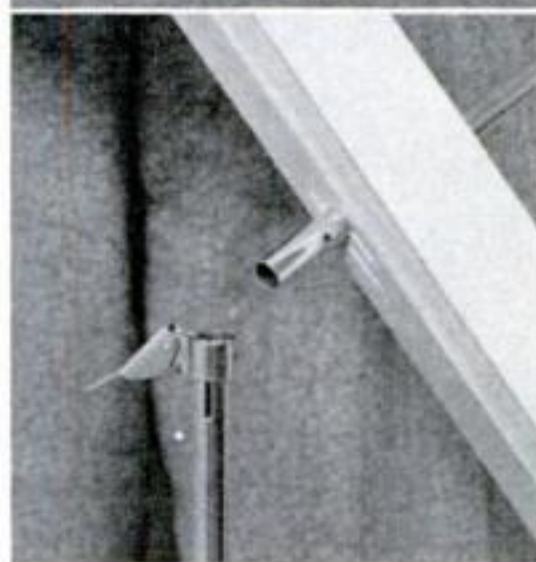
Short Cuts and Tips

FROM PS READERS



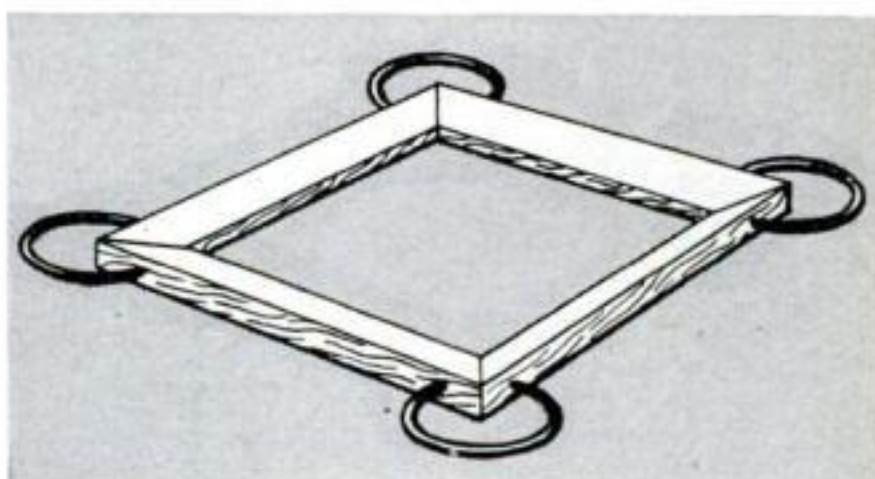
Portable Backdrop for Photography

A WHITE window shade supported on a telescoping photo-light stand makes a fine portable backdrop for portraits and for photographing small objects. A piece of one-by-two is used for mounting the shade. In the middle of the 1" side, bore a hole the same diameter as the center tube section of the stand. Push the section through about 2" (left), and reassemble the stand. The shade is then pulled up (above, left) and fastened to the top for portraits; allowed to drape along the floor (right) for studies of small objects.—J. W. Quin, Vancouver, B. C.



Lighting a Record Player

I FIND a sewing-machine lamp handy for lighting up my hi-fi record-player compartment. The lamp reflector directs the light on the turntable and stylus. A refrigerator-type switch turns the light off when the compartment is closed.—R. Stille, Rio de Janeiro, Brazil.



Frames Clamped with Springs

HERE'S an easy way to clamp picture frames for gluing. I use sections of coil springs sharpened at each end. The pressure is equal, and adequate for quick-setting glue joints. The clamps are simple and cheap—salvaged from old bed springs.—George F. Lamb, Pittsburgh.

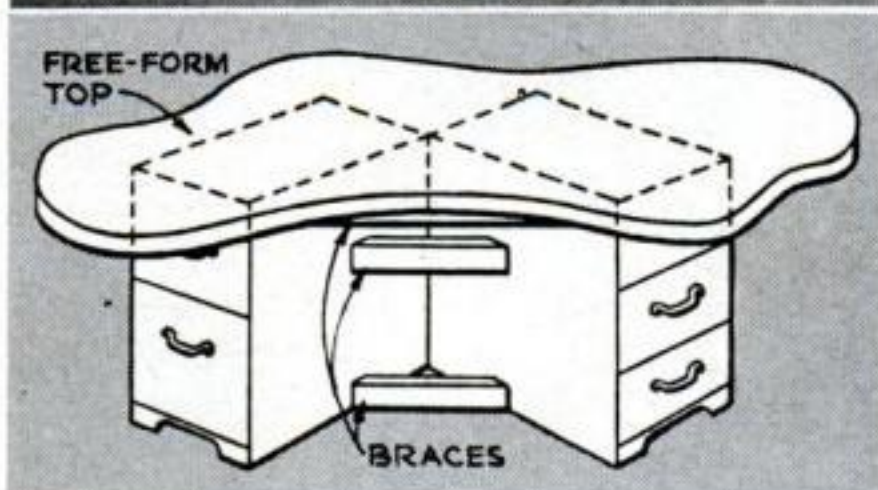
Short Cuts and Tips

FROM PS READERS

Angled Drawers in V-Hole Desk

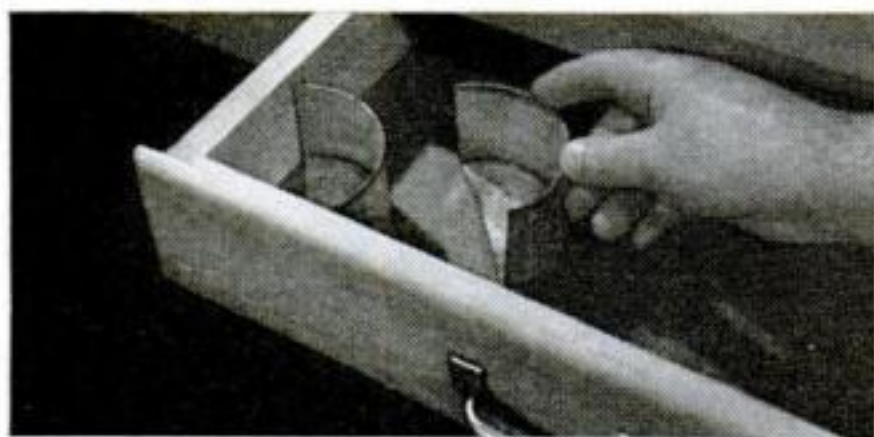
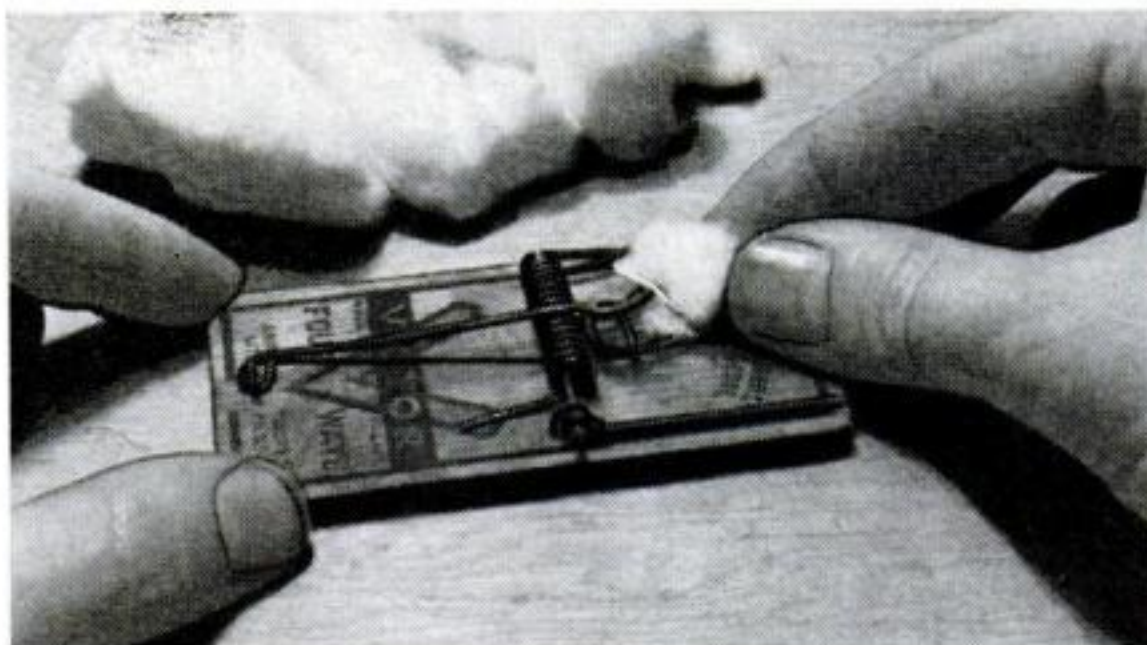
Two drawer units and a free-form top make this V-hole desk. The cabinets were joined at an angle and braced, then capped with a plywood top. The drawers open outward at a slight angle, can't bump the chair. Every outswinging curve of the new top offers work space; the desk can "seat" five, doubles as a card or dining table. Old knee-hole desk halves, two-drawer files, or night stands could be used as supporting cabinets.—*G. David Farkell, White Bear Lake, Minn.*

▶▶▶ You won't keep undersize fish if you check them on a ruler glued to the top of your tackle box. Or you could paint inch marks on your fishing rod.—*Mrs. Edwin Johnson, Iron River, Mich.*



Better Bait for Mousetrapping

Using cotton as bait will get you a higher percentage of successful trap trippings than cheese or other food. Mice like it for making their nests. To foil mousy sneak thieves, attach the small ball of cotton to the trap with a bit of string or strong thread.—*Wayne Floyd, Fayetteville, Tenn.*



Split-Can Drawer Bins

Small tin cans cut in half make neat drawer compartments to hold radio parts, nails, screws. Tacked to the bottom of a drawer, they fit snugly into sides or corners.—*Ken Murray, Colon, Mich.*

Hanging Coat Inside a Door

AN OVERCOAT hung inside a closet door often spreads out, and the sleeves get caught when the door is closed. Two doorstops put in as shown—an inch from the edge of the door and a little above where the coat cuffs go—will keep the sleeves where they belong.—*Frank Shore, NYC.*





Solved: the Wet-Basement Problem

**You can now waterproof walls
with a powerful epoxy plastic**

By David X. Manners

A NEW treatment keeps water out of flooded basements by sealing the walls like the bottom of a boat. This remarkable waterproofer is, in fact, a powerful epoxy plastic similar to the epoxies used to waterproof boat hulls. The big difference is that you put it on the *inside* of the walls instead of the outside as with a boat. A typical treatment costs \$75 to \$100.

Applied like paint, the epoxy coating bonds so strongly to basement walls that water pressures up to 40 pounds per square inch won't dislodge it. In tests,

masonry blocks ruptured before the plastic film did. It can be applied to brick, stone, masonry block, or concrete walls.

Proof that it works. Field-tested for three years by the Community Waterproofing Co. of Westport, Conn., the epoxy waterproofer has been used in hundreds of basements, many of them severely wet, without a single reported failure.

In most cases, it is not necessary to coat the entire wall. Most basements leak only at the point where floor and walls meet or through hairline cracks. Coatings are thus applied only in a foot-wide strip at the floor-wall joint and in narrow bands over cracks. Cracks do not have to be chipped out. The powerful plastic bridges the gap and seals them tight.

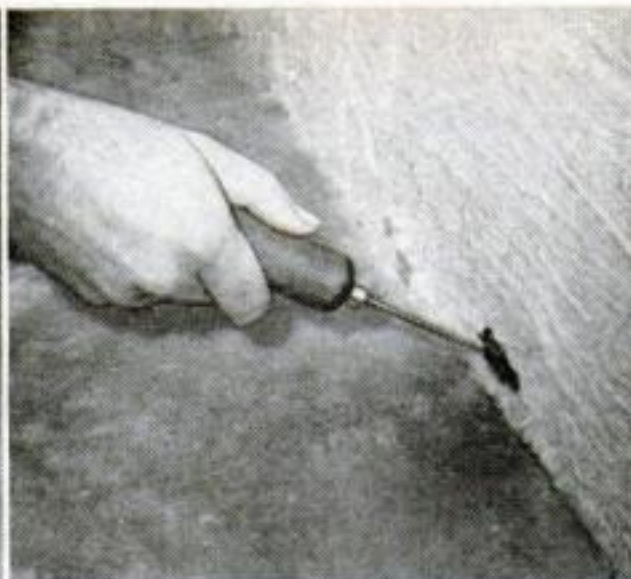
The epoxy apparently lacks most of the shortcomings of many other inside

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FLOOR CRACKS like this are a primary source of leaks. Dry out cellar thoroughly before applying epoxy waterproofer. You can rent a water vacuum if basement is badly flooded.



PROBE FOR LEAKS with an ice-pick along base of walls where water pressure is worst. Scrape out any loose or crumbly concrete down to a solid base so that patches will hold firmly.



POCKETS OF WATER often collect in the core holes of block walls. Drill holes along the base of the walls with a masonry bit so water can drain out before you apply the waterproofer.

waterproofers. It doesn't deteriorate with age. It isn't affected by heat, cold, or corrosion. It doesn't shrink or expand, opening up leaks. Nor is it affected by water-generated chemical action that causes many other coatings to fail.

How you buy it. Epoxy for basement waterproofing is packaged in one-pound cans only. The material begins to harden within 15 minutes after mixing, so a larger size would be impractical. One pound will cover about 20 feet along the base of dense-concrete walls, somewhat less on more porous concrete block and cinder block. Usually, 12 to 20 pounds will permit two coats in a typical 25'-by-35' basement.

As yet, epoxies for waterproofing are not widely available. One type developed especially for home use is called Community Epoxy and can be obtained by mail.*

What epoxies are. Developed in Switzerland, epoxies are a whole new class of paints, varnishes, and adhesives. They stick like the most powerful adhesives known and are impermeable to water.

Epoxies have already proven themselves on boat hulls and swimming pools. The epoxy used as a basement waterproofer was originally developed for use industrially as a waterproofing liner for tanks holding acids and other corrosives.

First, find the leaks. Epoxy will bridge hairline cracks, but it won't fill holes. These must first be stopped with a hydraulic cement such as Quick Plug or Waterplug. There are four or five active

leaks in a typical wet basement. The simplest way to find them is to mop up an area, then watch to see where water begins to infiltrate. You can then mark these points for special attention.

If basement walls are blocked, the bottom one or two courses may be full of water, which can continue to seep in slowly for days after a rain. Drill holes near the bottom of the blocks with a $\frac{3}{8}$ " masonry bit and you can drain the water in a hurry. Use hydraulic cement to re-seal these holes, as well as any others through which water has been flowing. In high-water-table areas, the best procedure is to locate leaks during a wet season, then postpone waterproofing to the driest period.

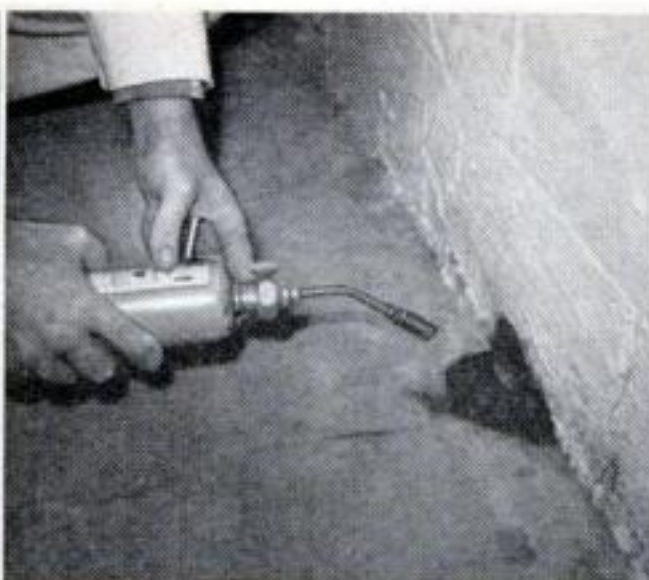
An icepick is useful in probing for leaks. The location of pools of water on the floor is not always an accurate guide as to its origin. Leaks may be in walls you least suspect, such as a wall adjoining the unexcavated area under a garage. Builders often skip this wall when putting in drain tiles, figuring that with the garage to protect it, it won't need tiles. Basement corners and pillars are also critical.

Preparing the surface. Surfaces must be absolutely dry during the application of epoxy and its hardening. Depending on temperature and humidity, hardening takes eight to 12 hours or more. If water comes through before the epoxy sets, it will create holes in the film. Even a pin-point hole can leak a flood of water in a few hours. The area will then have to be redried and pinholes sealed by another coat of epoxy.

*Community Waterproofing Co., 10 Red Coat Road, Westport, Conn., sells epoxy for do-it-yourself use at \$4.95 a pound.



PLUG HOLES AND CRACKS with hydraulic cement. This should be molded into small cone-shaped globs in your hand. As soon as it begins to heat up, ram it in the hole and pack it tight.



YOU CAN SPEED HARDENING of hydraulic-cement patches with a small torch. This can also be used to dry up any remaining wet spots in the cellar before you cover them with epoxy.



BRUSH IT ON LIKE PAINT. In most cases, only a narrow band at base of walls needs epoxy treatment. Spread it 3" up walls, 9" out onto floor. Cover cracks and 2" beyond on each side.

Once the cellar is dry, wait for three rainless days before applying epoxy. It will take at least that long for floor cracks to dry out thoroughly. If there is any lingering evidence of dampness, use a small torch to dry it out.

The epoxy must be applied to a sound surface. Loose paint, dirt, efflorescence, and previously applied coatings should be wire-brushed, sand-blasted, or ground away. Epoxy will not bond to asphalt, grease, or oil. If asphaltic material has been applied to the floor-wall joint, it must be removed. Epoxy will bond tenaciously to paint. If the paint is sound, it can stay.

How you apply it. The epoxy is packaged in two parts: resin and reactor. They must be mixed together vigorously for not less than two minutes.

Because reactor and resin are the same color, it is impossible to tell by eye when they are thoroughly blended. Mixing can't be overdone. The resulting product is thin and is easily applied with a paintbrush. Use a cheap brush and throw it away afterward.

Brush a generous coating on the wall-floor joint, extending 3" up the wall and 9" out onto the floor. Give pillars and corners extra dosage. The epoxy can't be applied too heavily. A single pinhole will involve redrying and recoating later. Coat hairline cracks on walls and floors, lapping 2" on each side.

Where masonry is so porous and eroded that the epoxy can't bridge the gaps, the area can be glassed in much the same manner as a boat hull. At the floor joint, a strip of fiber-glass cloth is embedded

in epoxy, then given additional coats as the preceding ones dry.

The epoxy should not be used at temperatures below 45 degrees. High temperatures speed hardening. At 70 degrees, it will harden within eight to 12 hours. It can then be given another coat. It may take three or more coats in some spots to stop all leaks. Additional coats will not take as much epoxy as the first one.

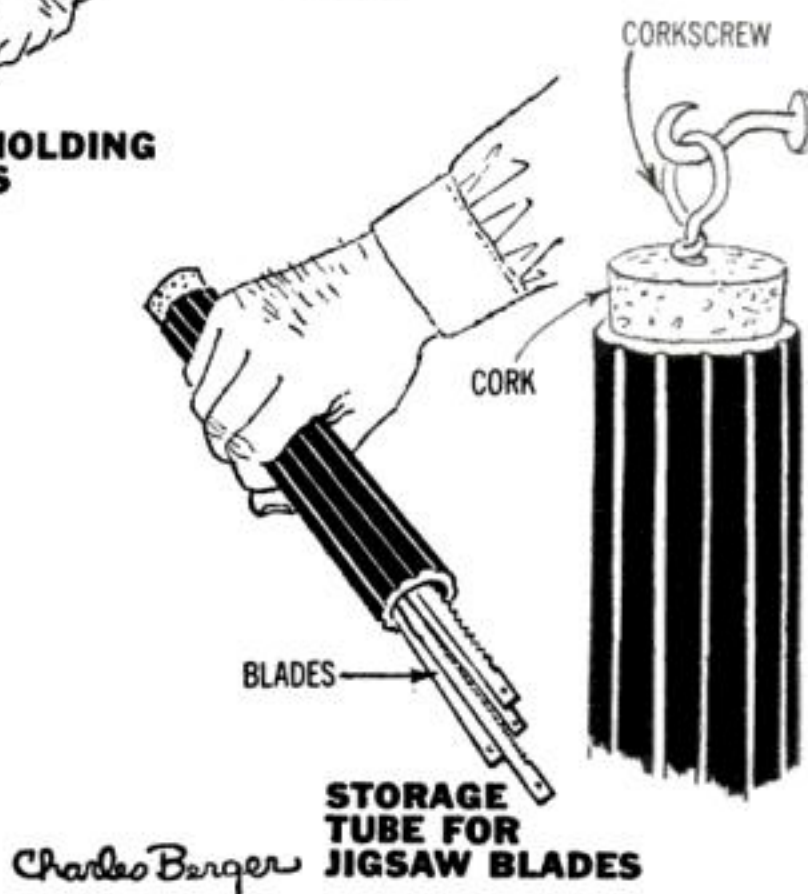
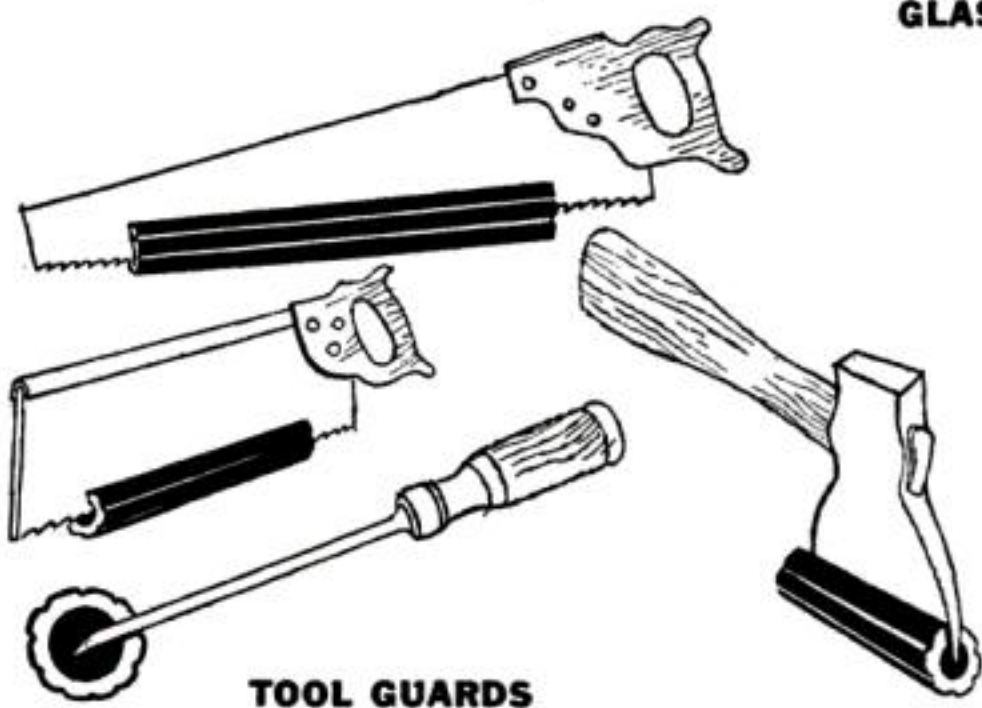
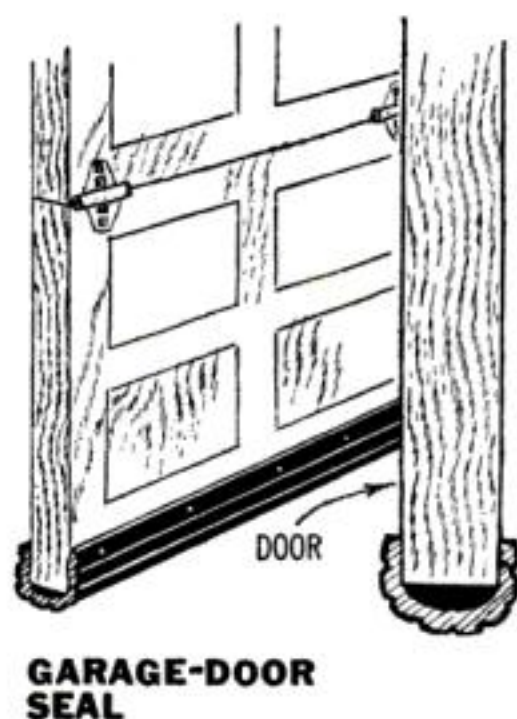
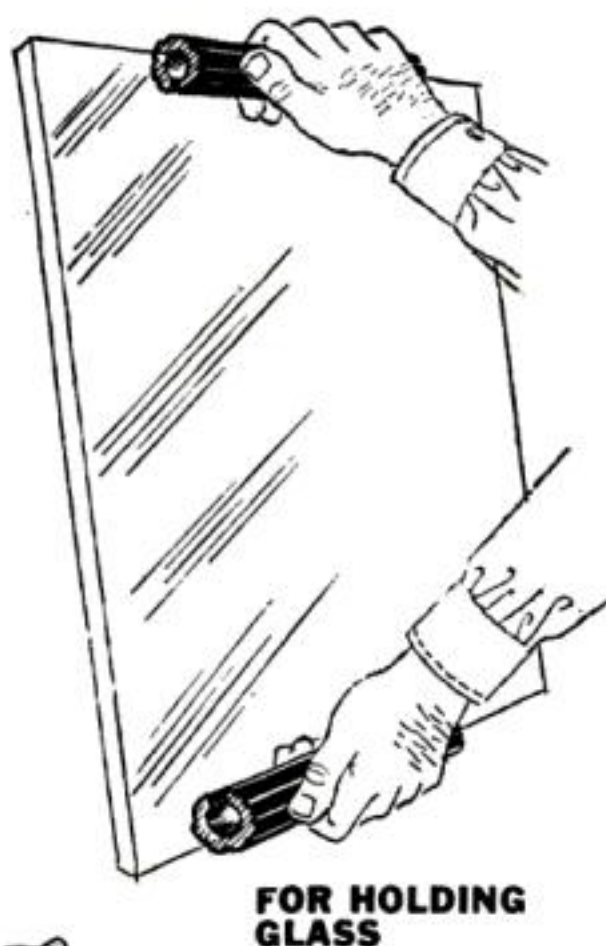
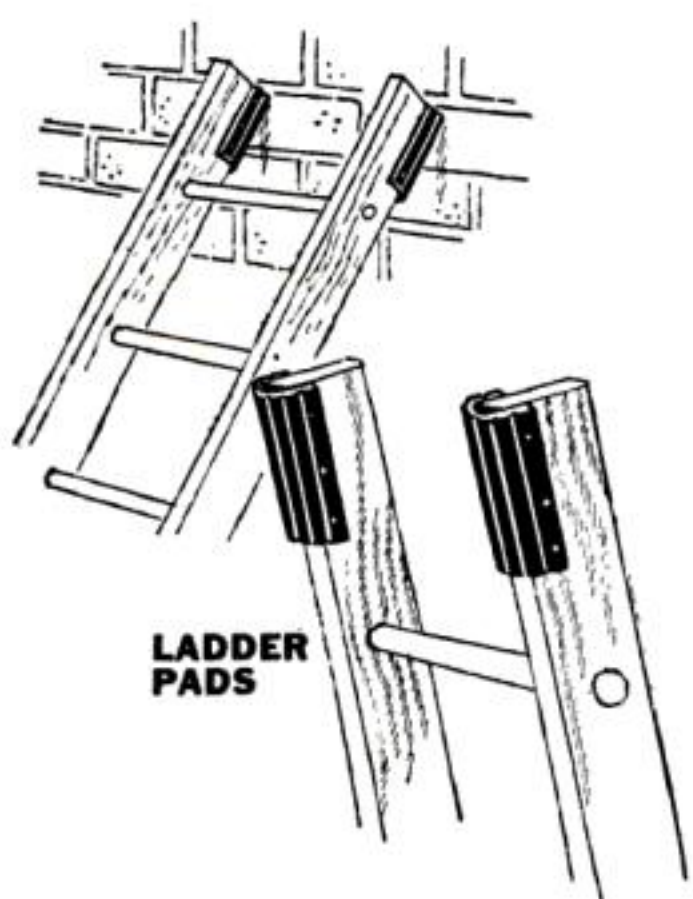
When dry, the epoxy has an amber hue and shine and may cause masonry to appear darker than surrounding uncoated areas. For decorative purposes, you can cover it with any variety of epoxy or rubber-base paint. Regular epoxy paints are available in many colors.

The tough epoxy plastic will continue to provide a barrier to water as long as it isn't broken, but if the house settles and new cracks develop, further waterproofing may be required. No surface becomes "paint-sick" from epoxy. There is no limit to the number of coats you can apply, and you never have to scrape off what has been put on before.

As a test, you may want to try epoxy on a small area. You'll find, however, that when epoxy is applied only where water is coming in, leaks may shift to other locations.

Is it a real leak? Be sure to distinguish between moisture originating in the basement and that coming in from outside. Many damp cellars result only from warm air condensing on cold walls. Often this can be cured simply by heating or insulating the basement. Sometimes finishing off a basement is all that's needed to dry it up.

Garden Hose Worn Out? Use It This Way

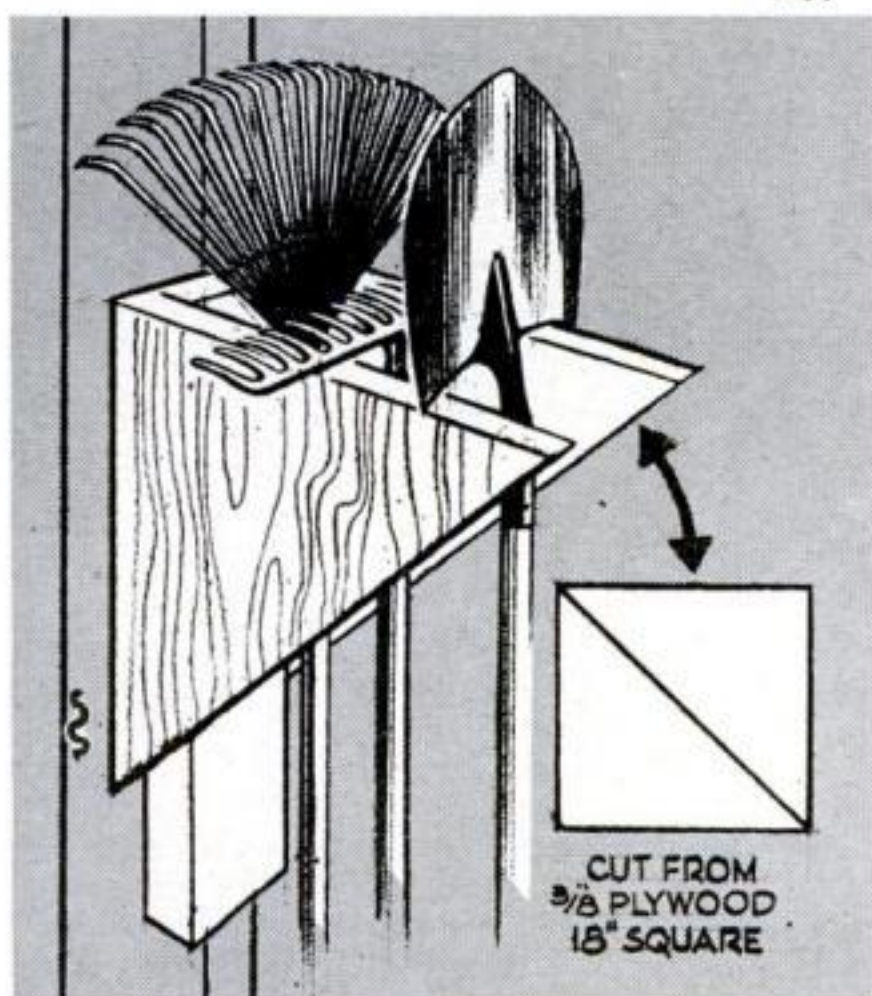
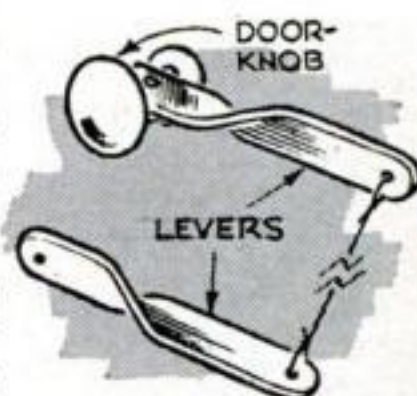


Short Cuts and Tips

FROM PS READERS

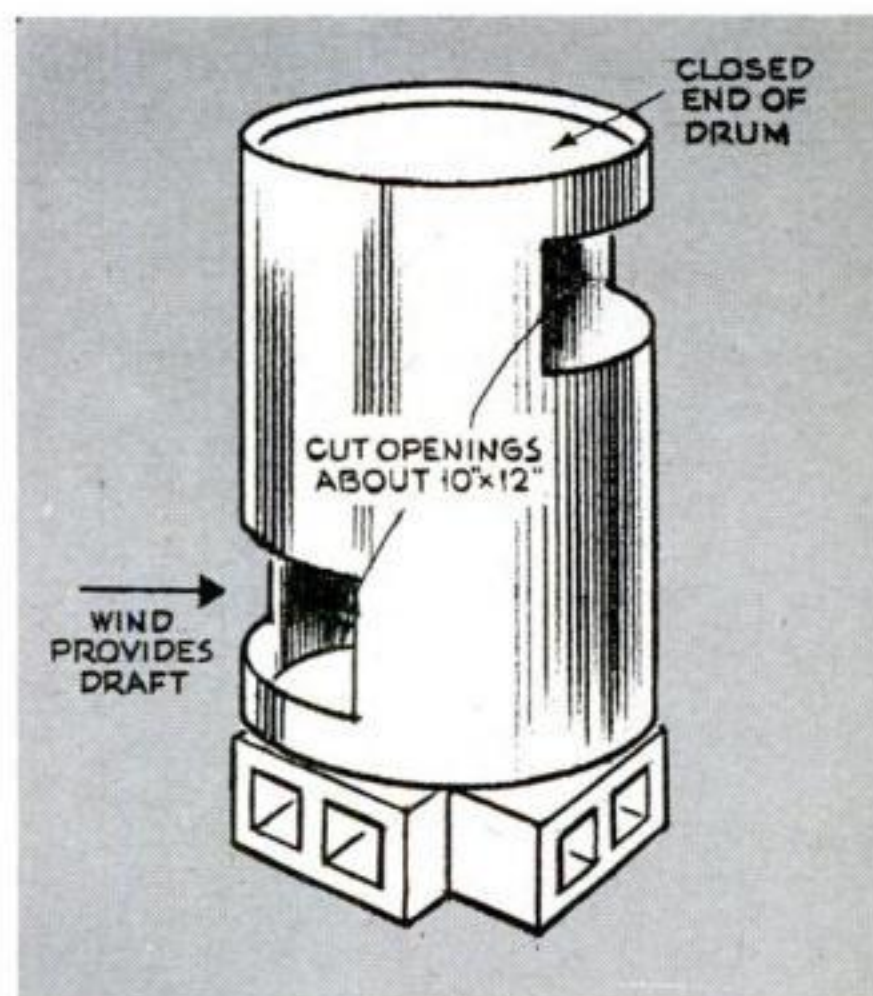
Foot Pedal to Turn Doorknobs

DOORS that are often used when you are carrying a two-hand load can be a nuisance to open. I found the answer in this foot-pedal device. Make two 6" metal strips as shown in the sketch below. Attach one to the knob with a screw slightly longer than the regular one. Screw in the other directly below, about 4" from the door bottom. Connect the levers with a length of taut wire. When you step on the lower strip, the doorknob will turn.—*Al Miller, Glendale, Cal.*



Rack to Hang Up Garden Tools

THE clutter of garden tools in my garage has given way to a neat and orderly arrangement. I hang them on a rack I made from two $\frac{3}{8}$ "-plywood triangles mounted to the wall on a strip of wood 3" wide. My rack, with the triangles formed by a diagonal cut across an 18" square of plywood, holds up to eight tools.—*Chester Johnson, San Francisco.*



Trash-Burning Drum Furnace

AN OIL drum set closed-end-up over a grate on cement blocks makes an efficient rubbish incinerator. Cut two 10"-by-12" openings in opposite sides of the drum, as shown. The covered top protects the trash so it will burn despite dew or rain. For a good draft, turn the drum so that the bottom opening faces into the wind.—*A. D. Allen, Plainfield, Ind.*

The Kit Way to Build a Clock

By Ernest E. Hickman

HERE'S different way to get a clock: Buy it as a boxful of parts. You won't need a shop full of tools to put them together, either. I know; I built this 17th-century walnut bracket clock in an apartment living room.

My workbench was a coffee table, my only tools a pocketknife, some rubber bands, and an artist's kneaded-rubber eraser. These were adequate; the clock case was built from a kit.

This was no ordinary "a-child-can-do-it" kit, however. This was a true wood-working project. Although the parts had been shaped and sawed, they required some fine trimming, gluing, sanding, and finishing before they became a clock.

The kit contained a supply of aluminum-oxide sandpaper. This looked skimpy—one 3"-by-5" sheet each of 3/0 and 5/0—but proved adequate.

To stretch the sandpaper, I tore an inch-wide strip from each sheet. I used these small strips, wrapped around the kneaded-rubber eraser, for sanding the moldings. The larger pieces were laid flat on the work table for butt-sanding end grains, or wrapped around parts of the clock as sanding blocks for flat surfaces.

Hand-sanding took a week of evenings. The same work could have been done on a belt sander in minutes. But there was

an unforeseen advantage to working in the living room—I could sand parts and watch TV without missing a gunshot.

Assembly without clamps presented a problem, as the top, sides, and front of the clock are mitered frames. The kit makers packed a special glue with the kit. And once squeezed together, glued parts stuck well enough so that I could snap a rubber band around the frames. This held them together until the glue set.

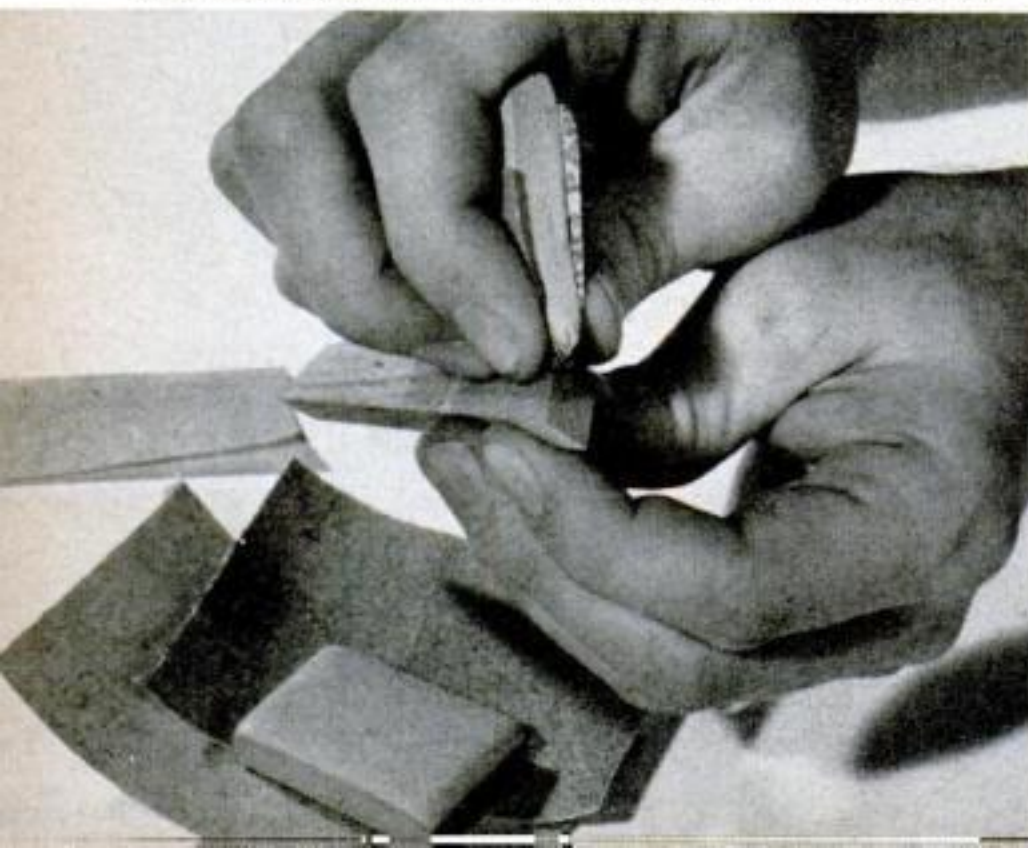
The completed clock got one coat of hastily wiped stain, and five of well-cut shellac. The well-worn 5/0 sandpaper was used to smooth intermediate shellac coats. The last coat was rubbed with 4/0 steel wool and paste wax.

After finishing both parts, I joined the door and clock case with the small brass hinges provided. These were carefully screwed into mortises made with my pocketknife. Then the clock motor was bolted to the face, and the face, in turn, was screwed into the clock. Glazing the door with the glass supplied in the kit completed the clock. It keeps good time.

Kits for building a clock are available in three designs—the 17th-century bracket clock, an Early American model, and a Connecticut shelf design. All three clocks can be had in your choice of two woods, walnut or mahogany. The kit I used came from Albert Constantine and Son, Inc., 2050 Eastchester Rd., NYC 61. It cost \$16.95.

ERASER made flexible sanding pad for smoothing moldings without damaging delicate parts.

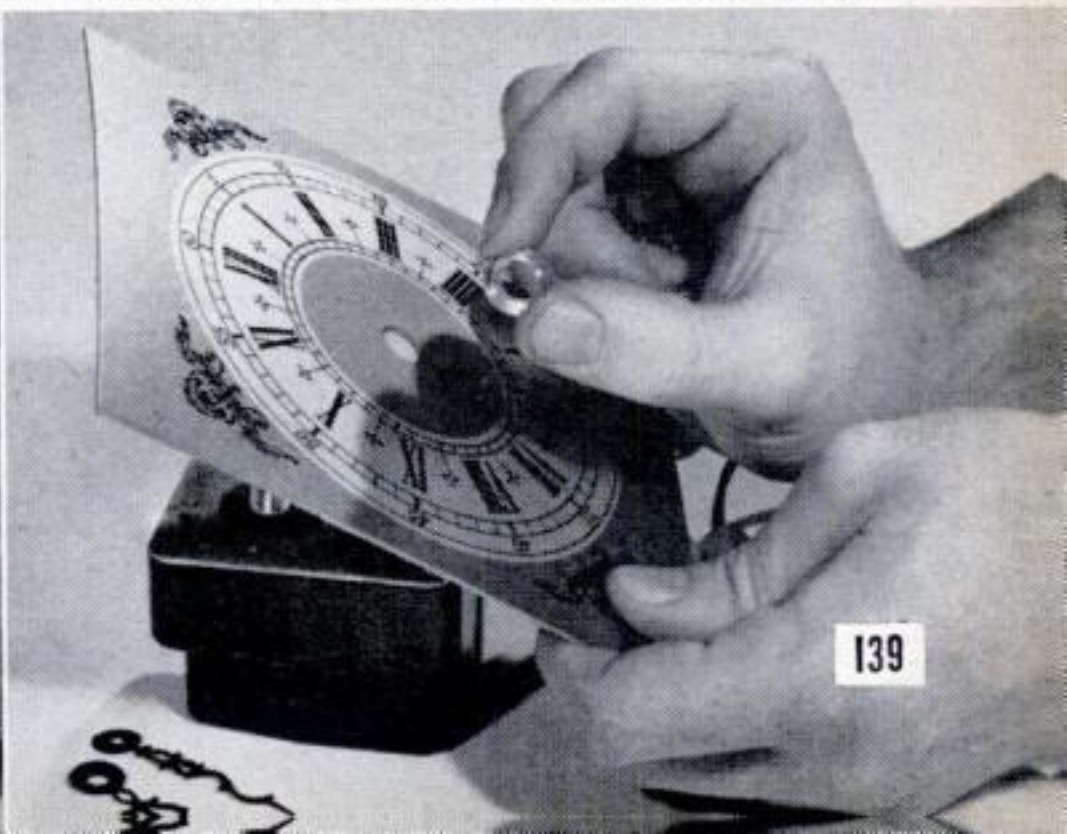
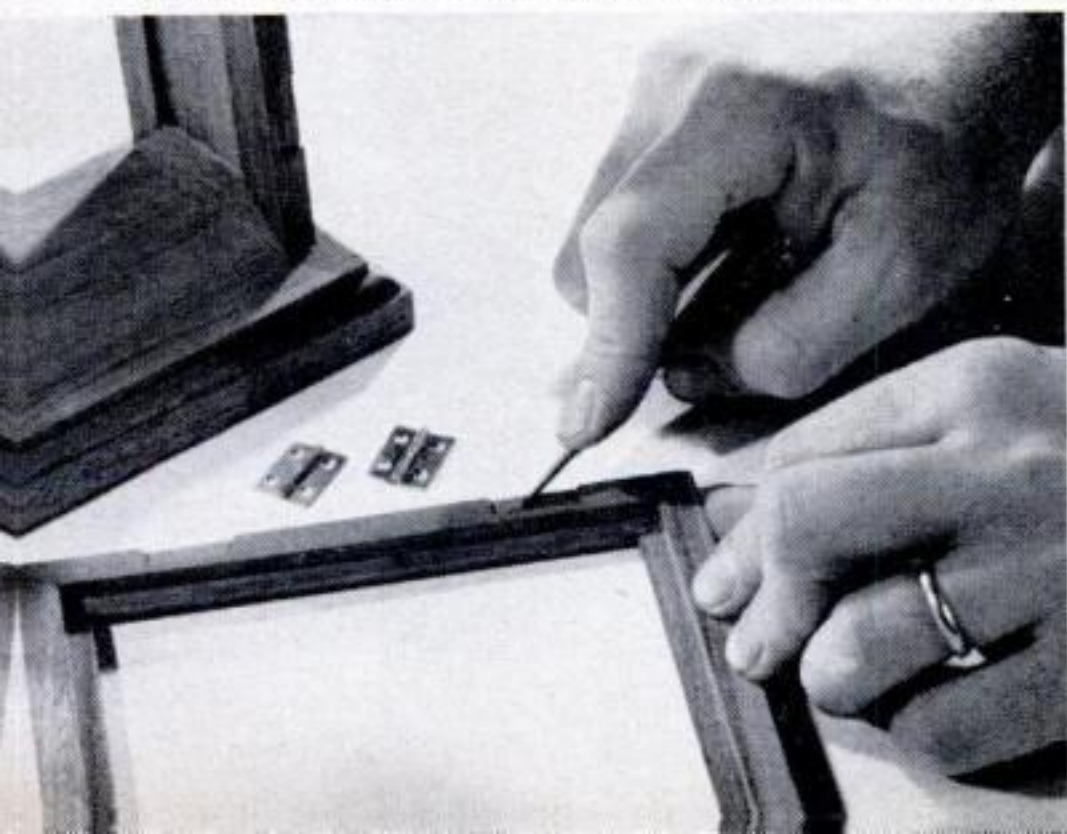
RUBBER BANDS served as clamps for holding the mitered frames together while the glue set.





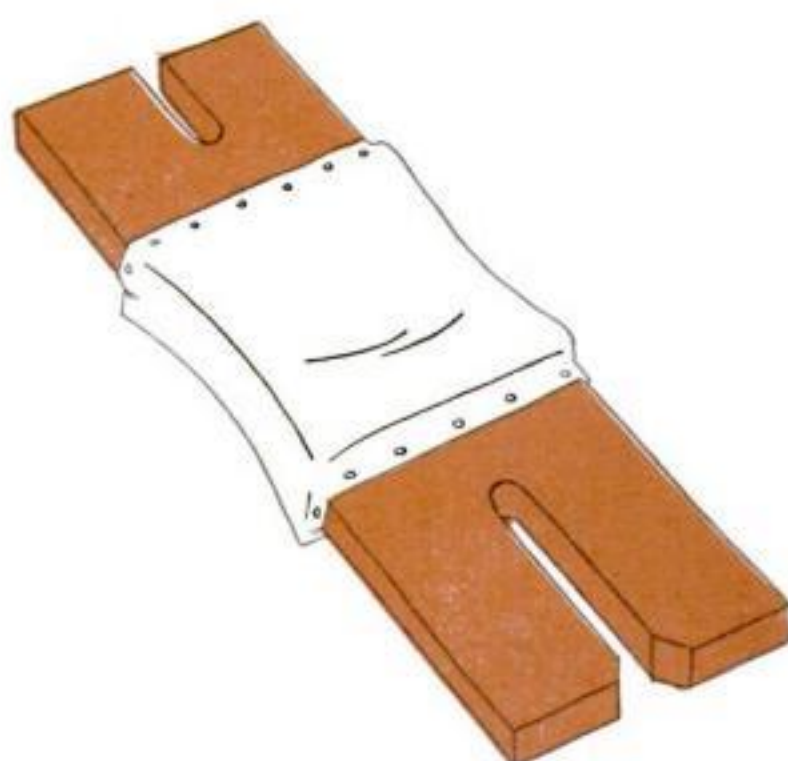
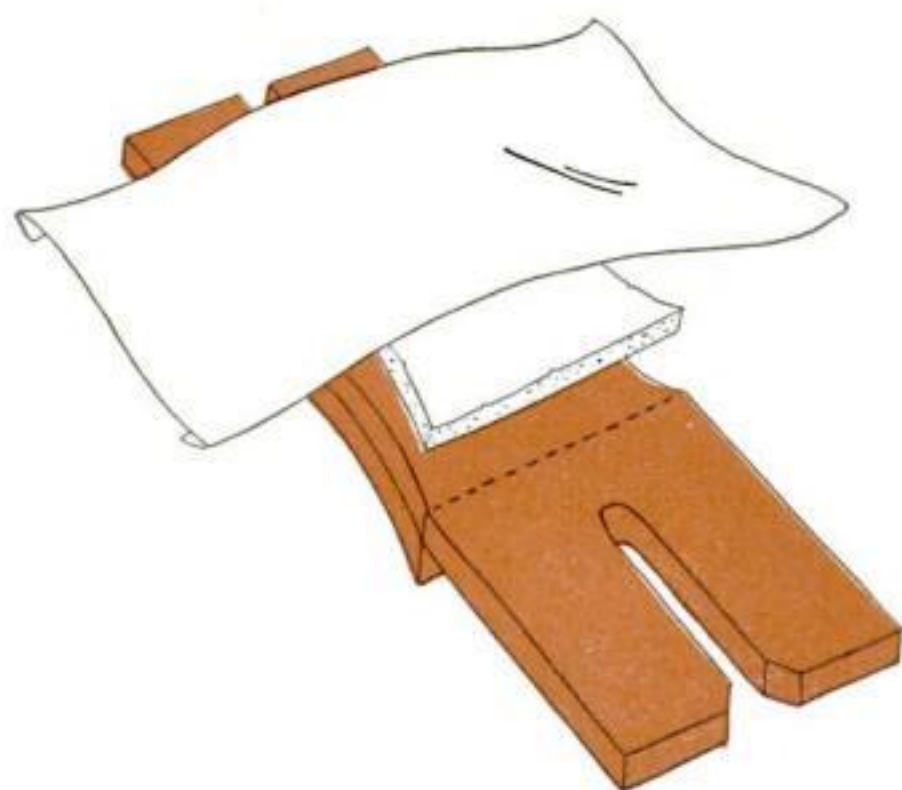
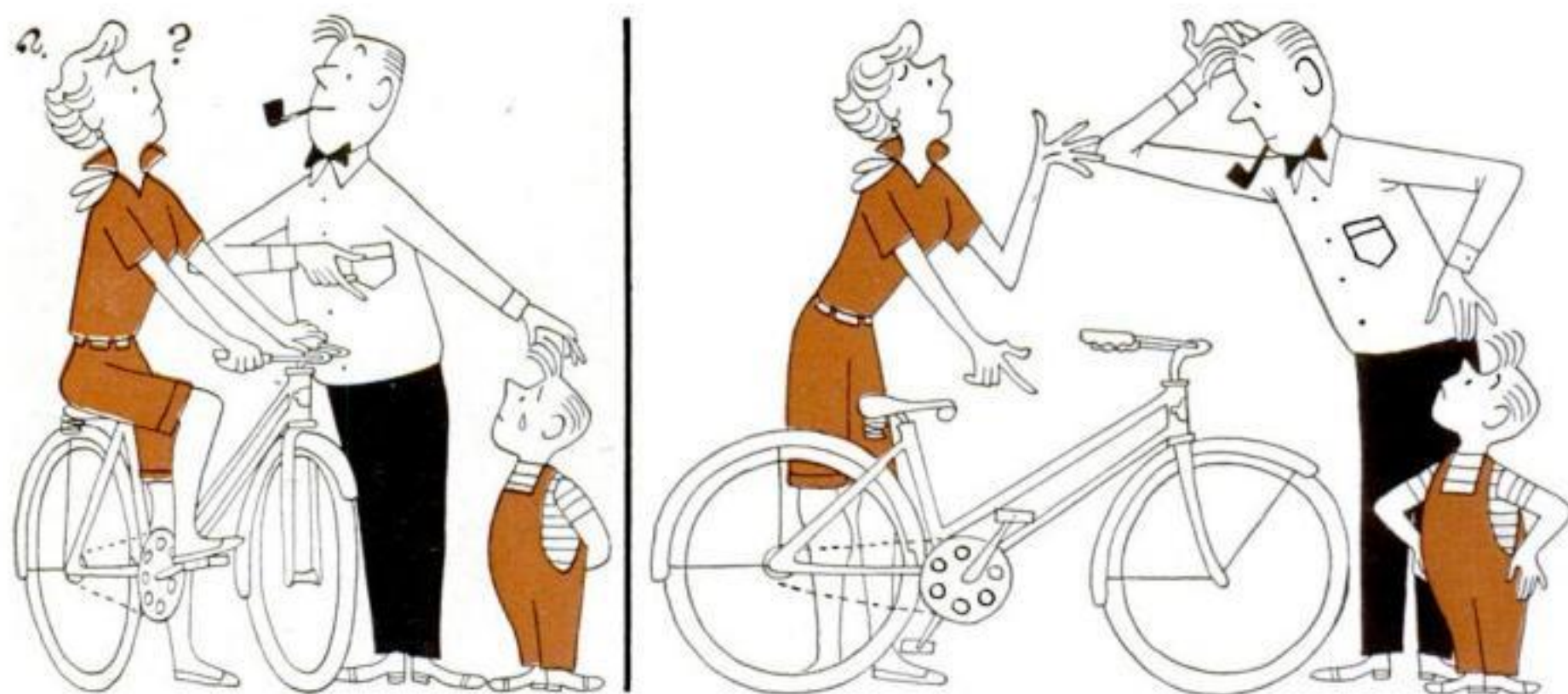
WHITTLED HINGE MORTISES were left empty until the last coat of shellac was on and rubbed.

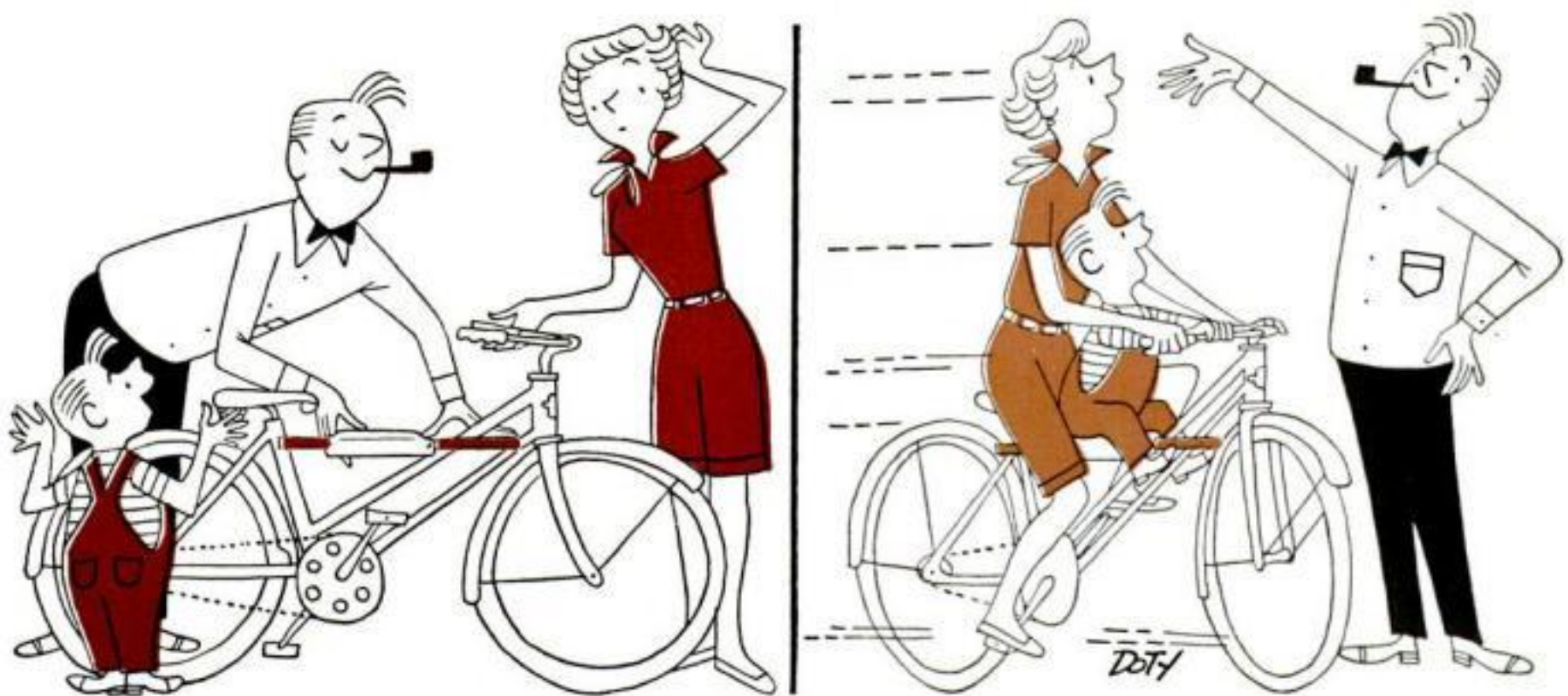
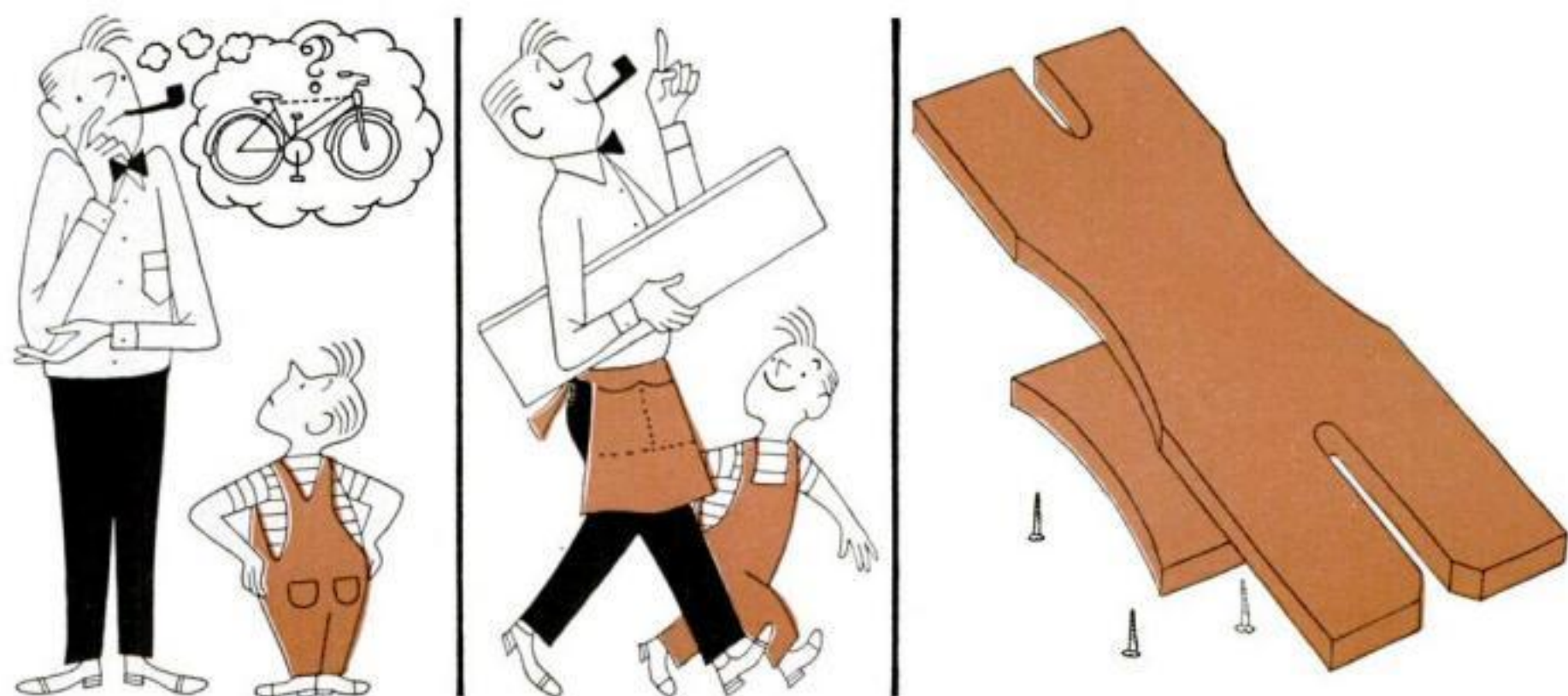
MOUNTING THE MOTOR: A round nut holds it to the clock face. Another nut holds the hands.



Wordless Workshop

By Roy Doty
and Andrew Biagioni





Short Cuts and Tips

FROM PS READERS

Cleaning Keys of a Typewriter

A STRIP of masking tape pressed against the keys of a typewriter and moved back and forth will pick up accumulated ink and dust. If the keys are very dirty, use a suede brush across them first.—*Bob Culter, Oswego, Ore.*



Mailbox Delivery Signal

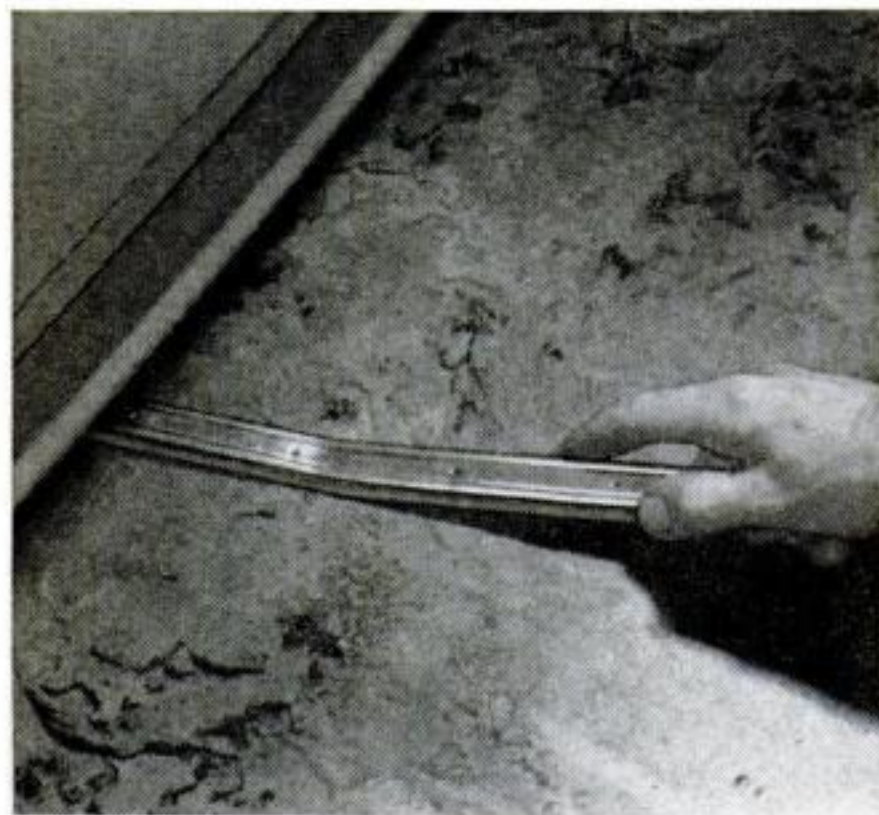
I NO longer make unnecessary trips to my mailbox to find it empty. The simple signal device I use is a yellow-painted strip of heavy-gauge aluminum bolted to the side of the box. The catch on the



closed door holds the strip in horizontal position. Opening the door to put the mail in lets the bar fall into vertical position. Better check with your postman first to see if he goes along with the idea.—*R. L. Grimes, Penfield, N. J.*

Cleaning Under a Refrigerator

A YARD-LONG piece of weather stripping makes a handy tool for cleaning under low-clearance refrigerators. Use the metal type that has a felt insert. Turn it so the felt touches the floor, and bend up one end of the strip to make a handle.—*Walter E. Burton, Akron, Ohio.*



▶▶▶ AN AMATEUR artist friend of mine who paints in oils uses an oblong piece of glass instead of wood for a palette. Glass is a good surface for mixing paints. If put into a shallow pan of water between paintings, the globs of expensive paint will remain fresh for re-use.—*Phillip J. Shuler, Acton, Cal.*

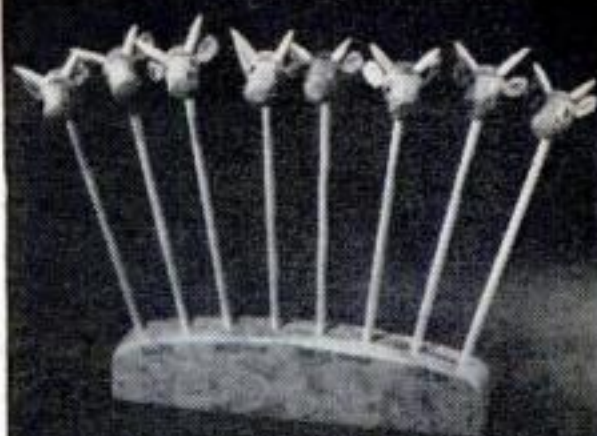


Here's one good way you can use up scraps of fine hardwoods:

Shop Projects for the Backyard Chef

By Edwin M. Love

ANY woodworker worth his salt soon builds up a collection of hardwood scraps. What do you do with them? Just throw them away? Well, you can if you wish—but I always see mine as a batch of potential projects. True, it takes a little ingenuity to create suitable designs and to work the little blocks. But that's part of the fun. The items shown on this and the following pages show possibilities.



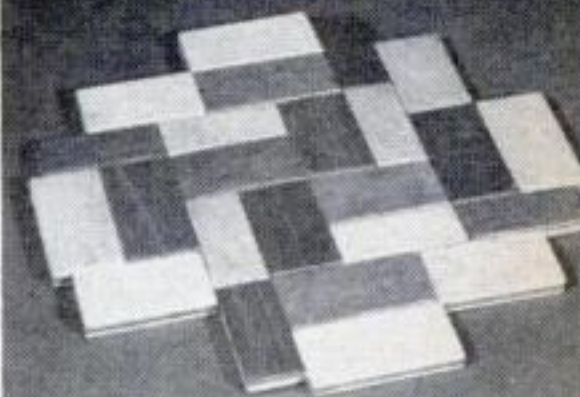
STEAK MARKERS



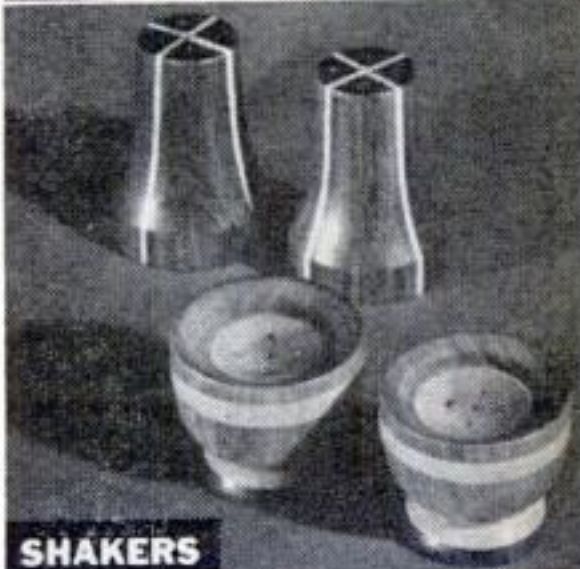
CANDLESTICKS



CHOPPING BLOCK

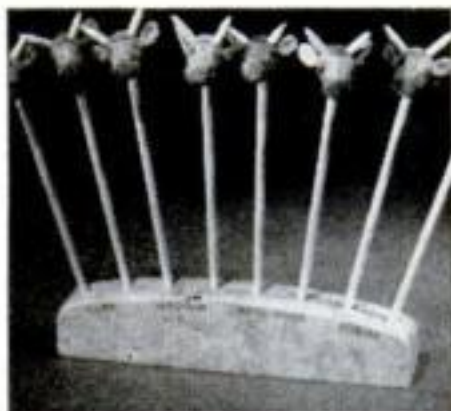


HOTPAD



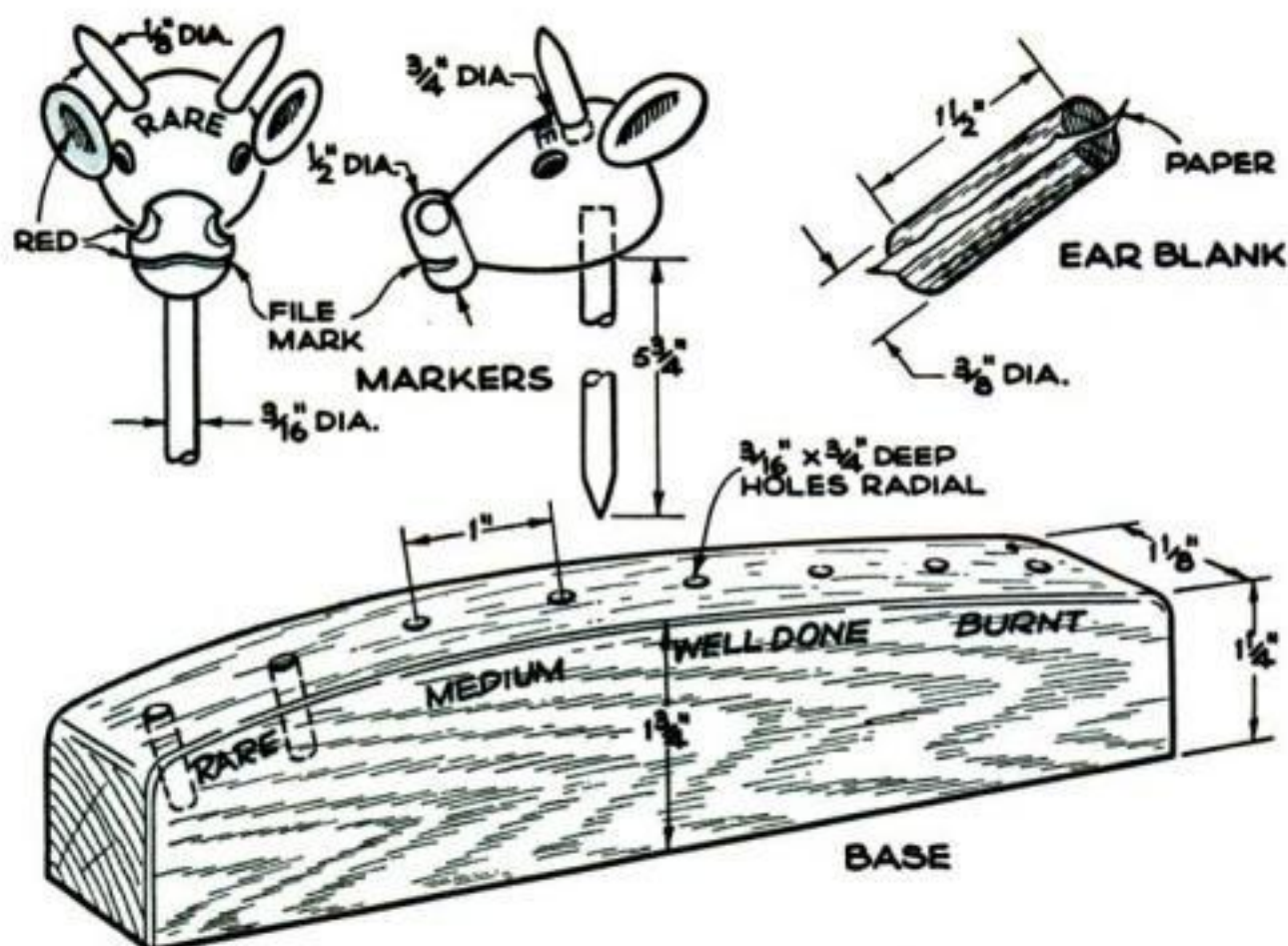
SHAKERS

CONTINUED



Steak Markers

TURN the heads to $\frac{3}{4}$ " diameter from suitable blocks, carving some of the features if you wish. Turn ears from dowel sticks that have been sawed down the middle and glued together with paper between. Split the pairs apart, file flats at the bases, and glue to the heads. Draw

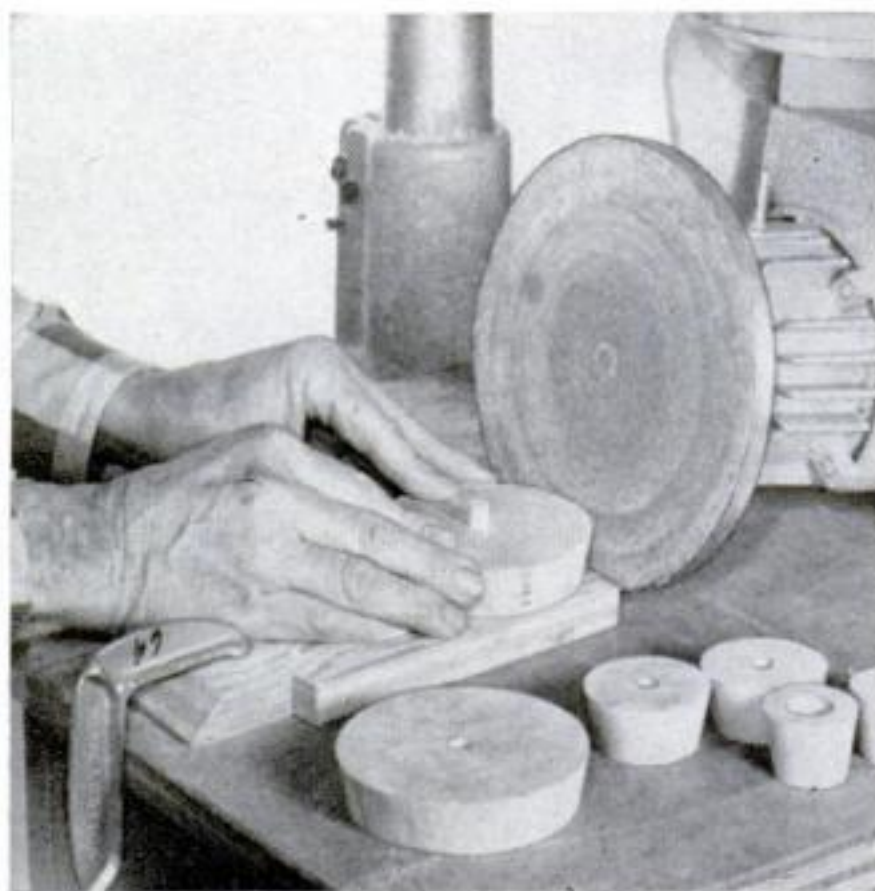
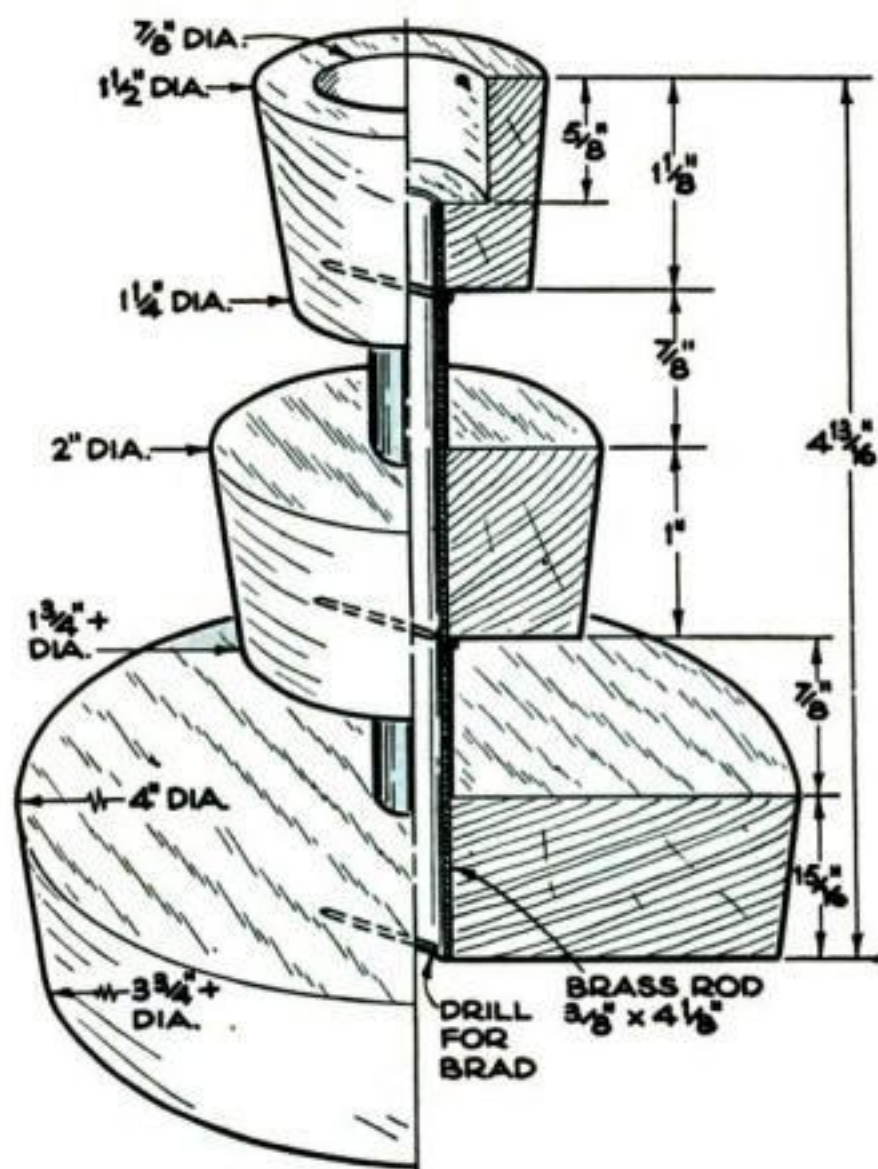


eyes with a black pencil, color mouth and ears with a red one. Clear finish will also seal markings applied with a pencil.

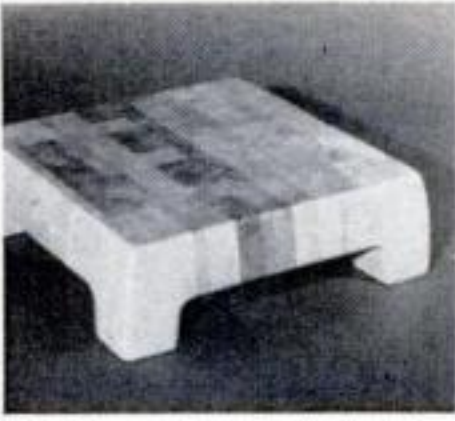


Candlesticks

A QUICKY project, these candlesticks look as if they were turned. Actually, they were shaped with a sanding disk. Jigsaw the pieces to rough shape, round them on a pivot jig, and sand all surfaces. Hold the pieces in place by drilling the brass rod so you can angle brads into the wood.



SANDING DISK mounted on a radial saw was used to shape parts. Make a pivot jig by setting a $\frac{3}{8}$ " dowel into a board, and slip the candlestick part over the dowel. Tilt disk to angle desired, clamp jig with work in contact with disk. Turn work on pivot as the disk turns.

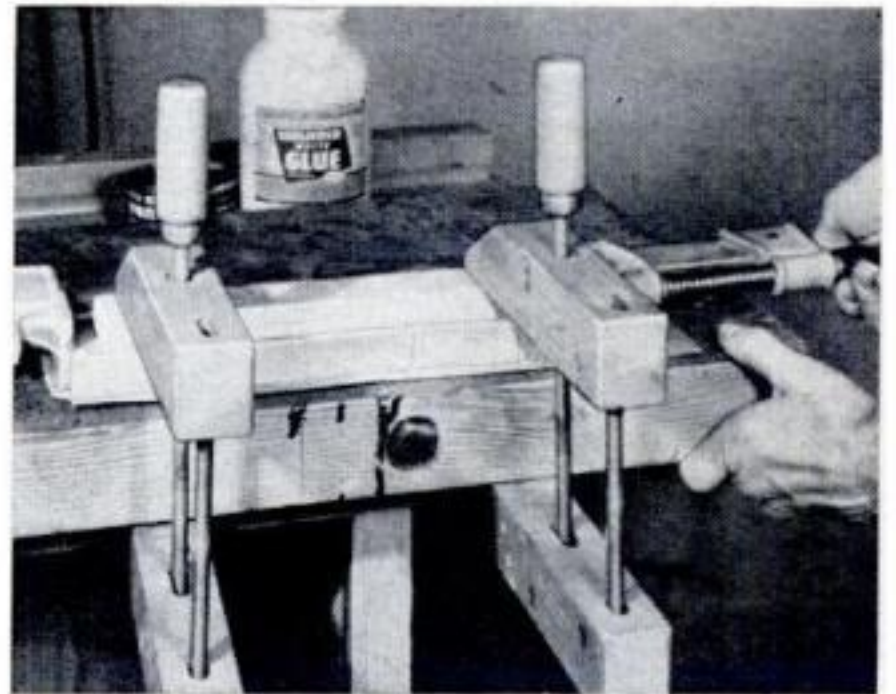
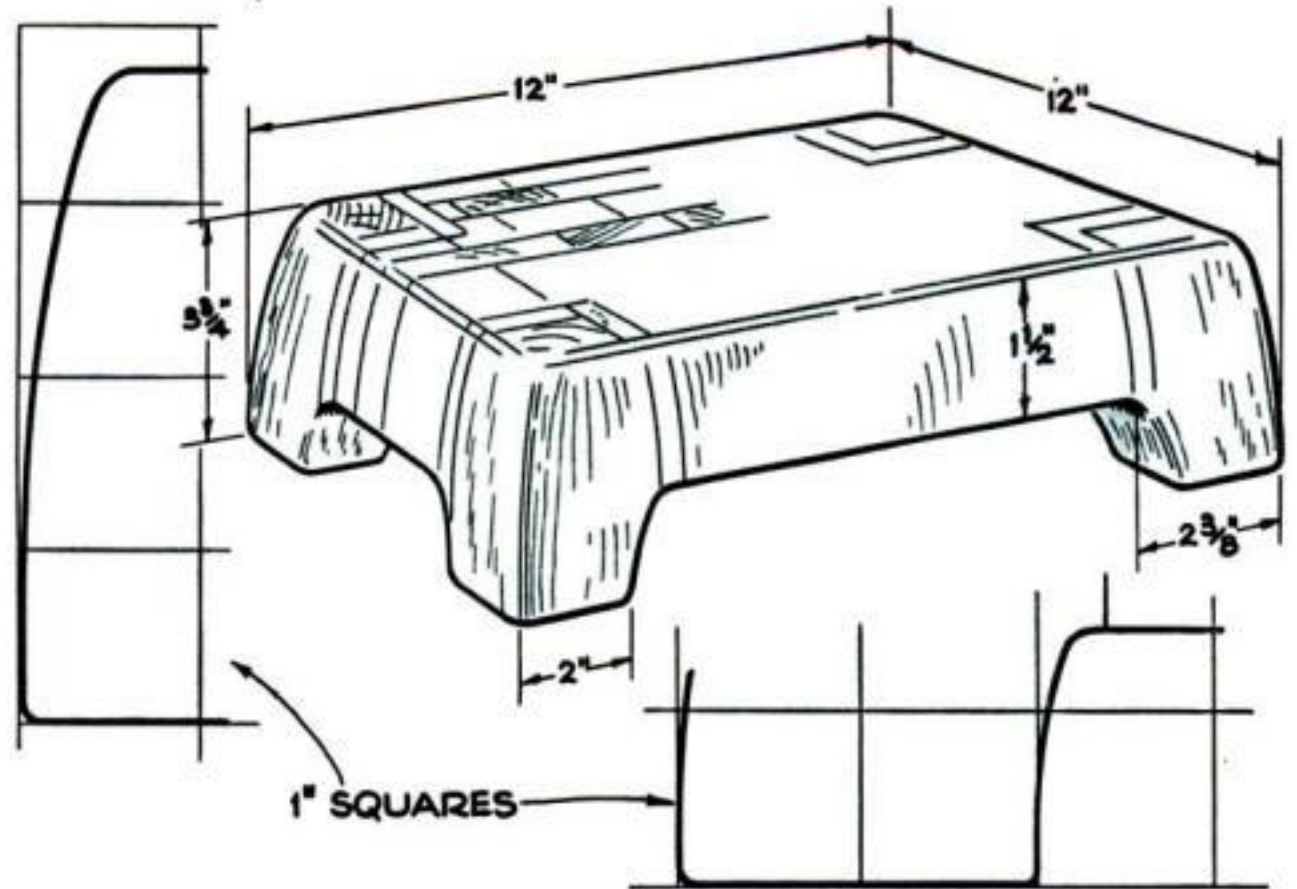


Chopping Block

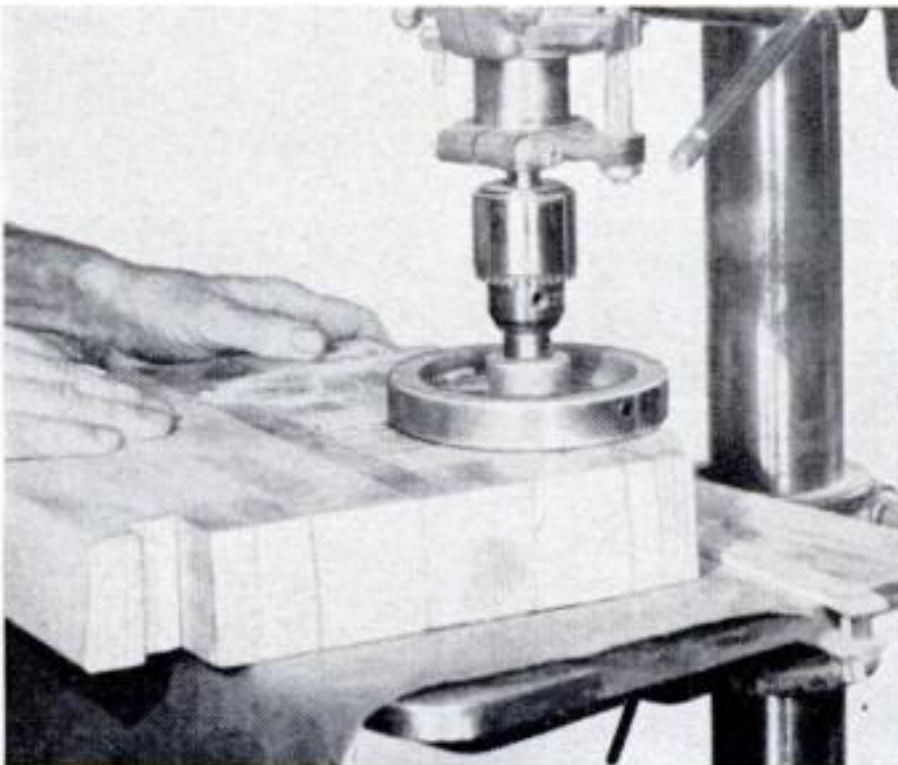
To USE up scrap, cut all blocks to the same length, glue them into strips with the grain of each block running vertically, and glue the strips into a plank. The legs are one-piece blocks glued into notches at the corners.

Size the blocks by pushing them (with a pusher stick) between a circular saw blade and the fence. A planer blade will cut them smooth enough for gluing. Parallel the edges the same way, but place the fence to conserve the width of the blocks; random widths look best. Take care in assembling to get a plank that is practically smooth; surfacing the end grain of hard maple is about like surfacing steel.

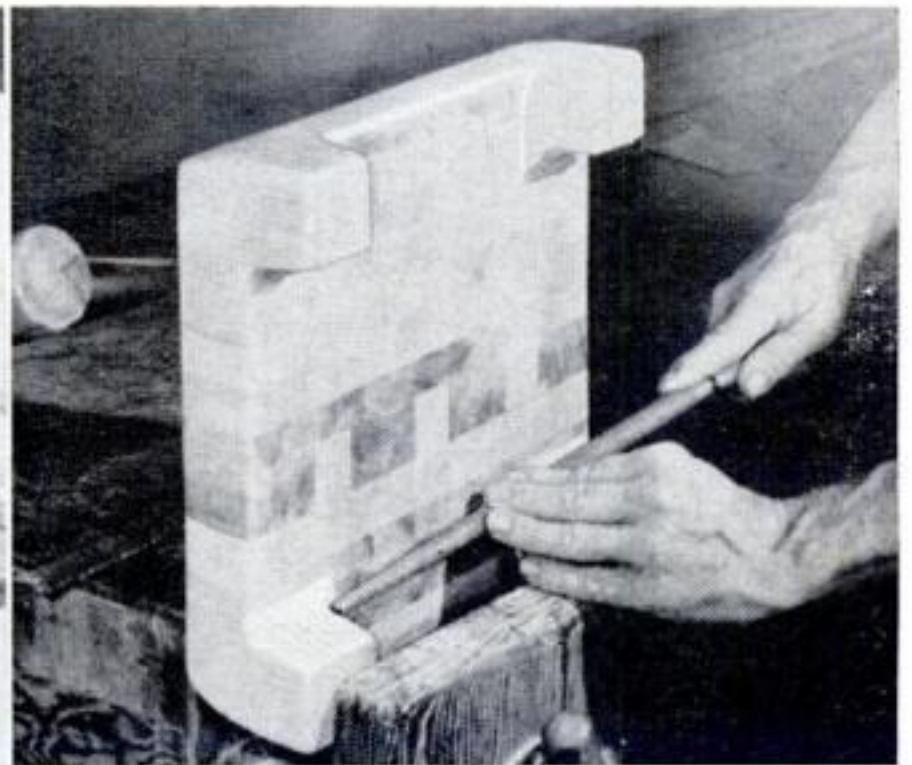
A coat of plastic resin of the kind used for "glassing" boats makes a good protective finish. Thin it a little with acetone. When hard, scrape the surface smooth and rub it with fine steel wool.



HOW STRIPS ARE FORMED: Lay a row of sized blocks on paper, pressing glued edges together. Place waste wood on top of the row, clamp to bench, then squeeze ends with a bar clamp.

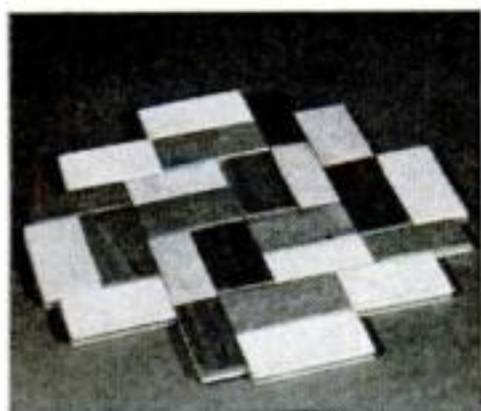


PLANK CAN BE SMOOTHED with a sanding disk in a drill press. Rest work on paper to avoid marring. Note notches at each corner of the plank for gluing in a one-piece leg block.



CABINET RASP is being used here to smooth leg fillets. Wood files are handy for rounding the corners of the chopping block. Hard maple is wood most suitable for this project.

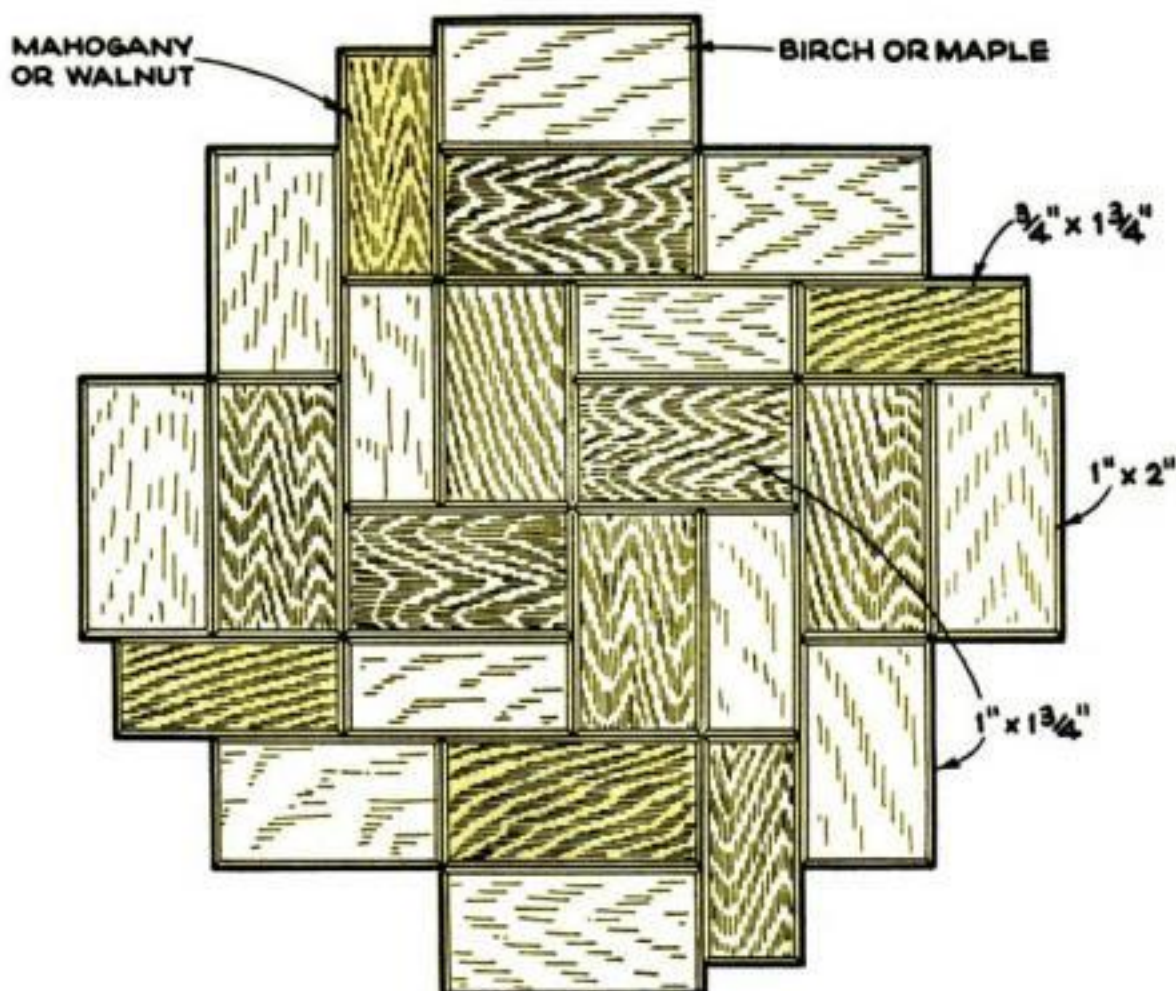
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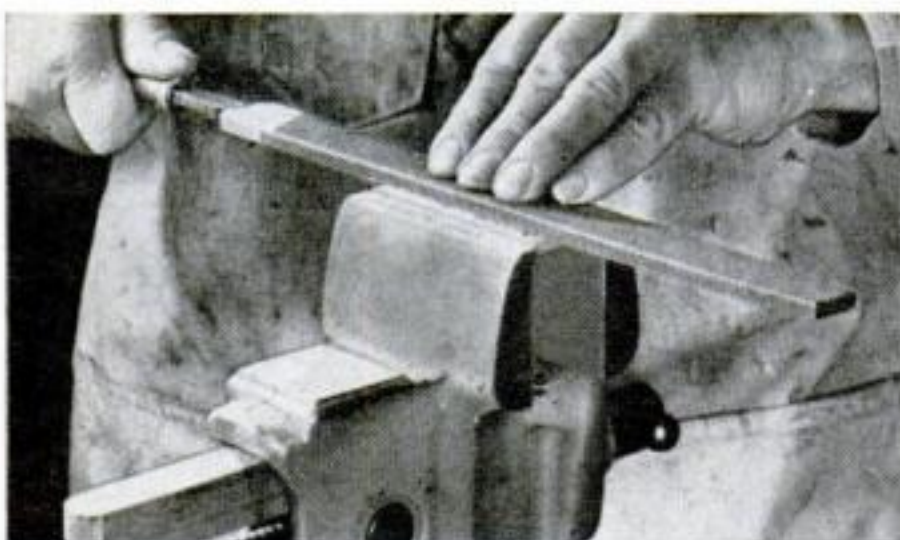
Hotpad

PIECES of wood $\frac{1}{4}$ " thick were used in three sizes to make this hotpad. Each piece was grooved on all edges with a circular saw blade to take the splines that hold the pad together. Cut splines from hardwood with the grain crosswise.

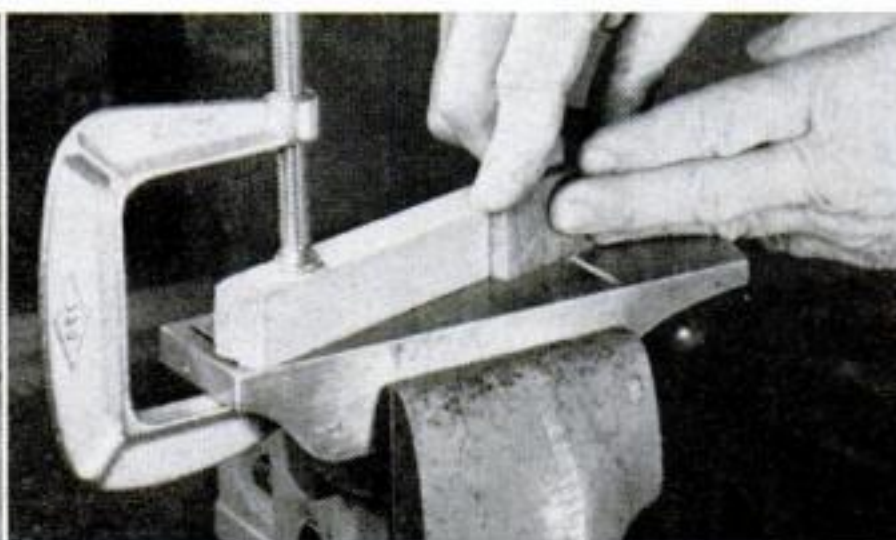
Lightly chamfer all edges of the pad pieces, and smooth each piece with a file, followed by light sanding. After the as-



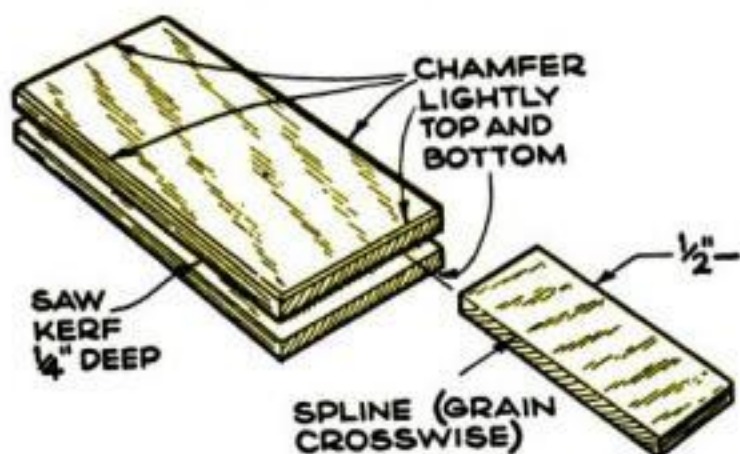
sembled pad has dried under a weight, fill the edge grooves with inlay strips or do it simply with wood putty.



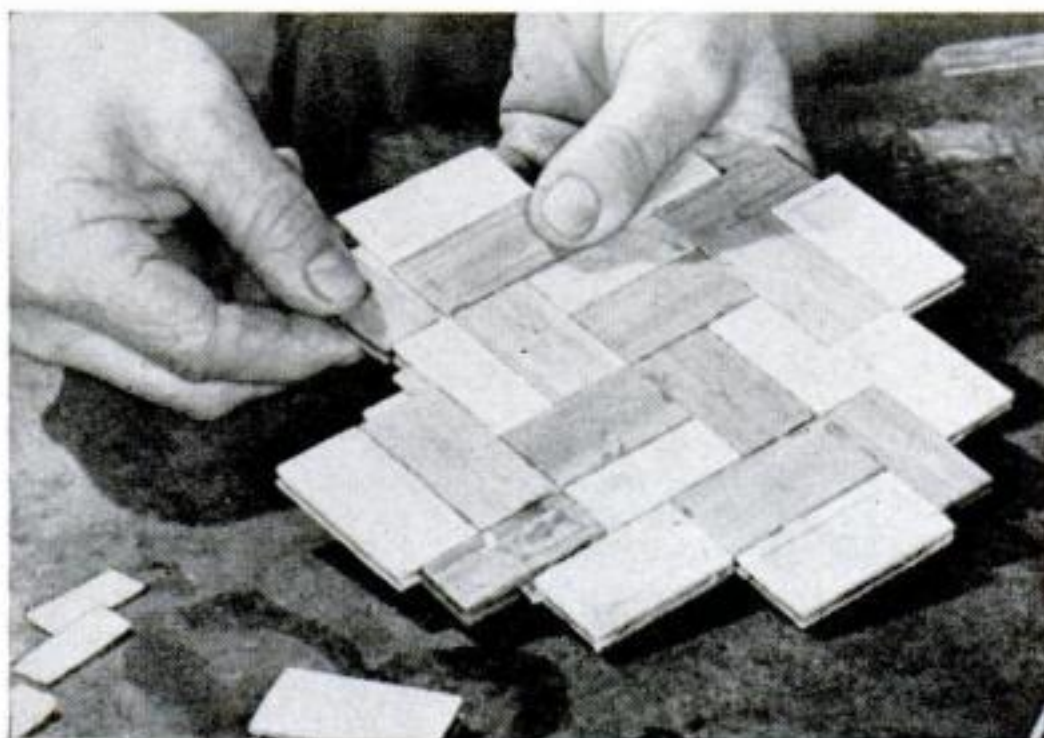
SURFACING THIN WOOD is easy this way. Held in the vise by its edges, the piece is rubbed with a flat wood file, the fingers applying pressure to the file directly over the wood.

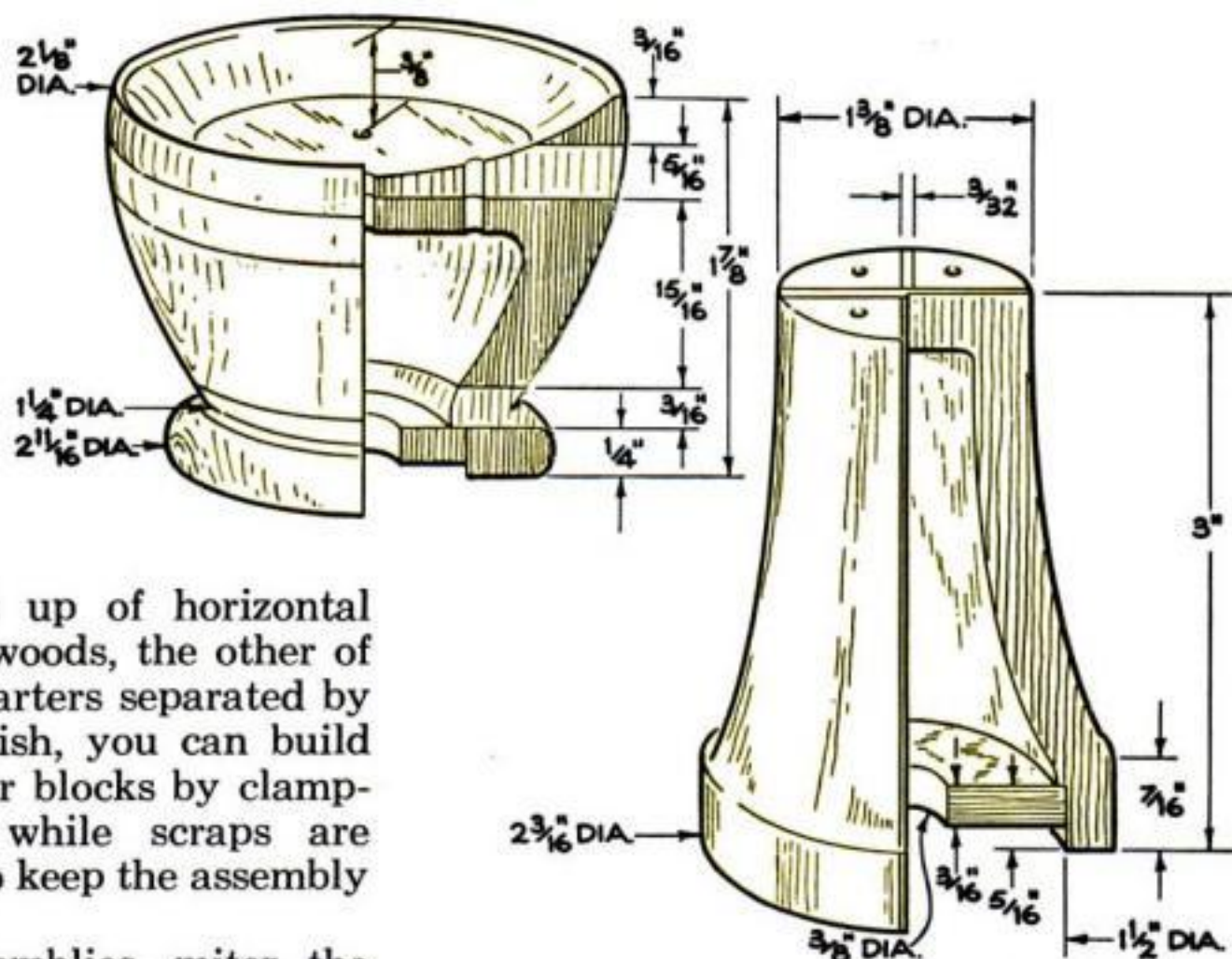


TO JOINT SMALL BLOCKS, clamp a strip of wood to the bottom of a plane and use it as a fence as the piece is pushed over the blade. Support the plane in a vise as shown above.



ASSEMBLY: Apply glue to the splines and force the blocks together with the fingers. Splines can be snipped off to any desired length. Rake glue from the grooves after assembly and weight the pad flat until it's dry.



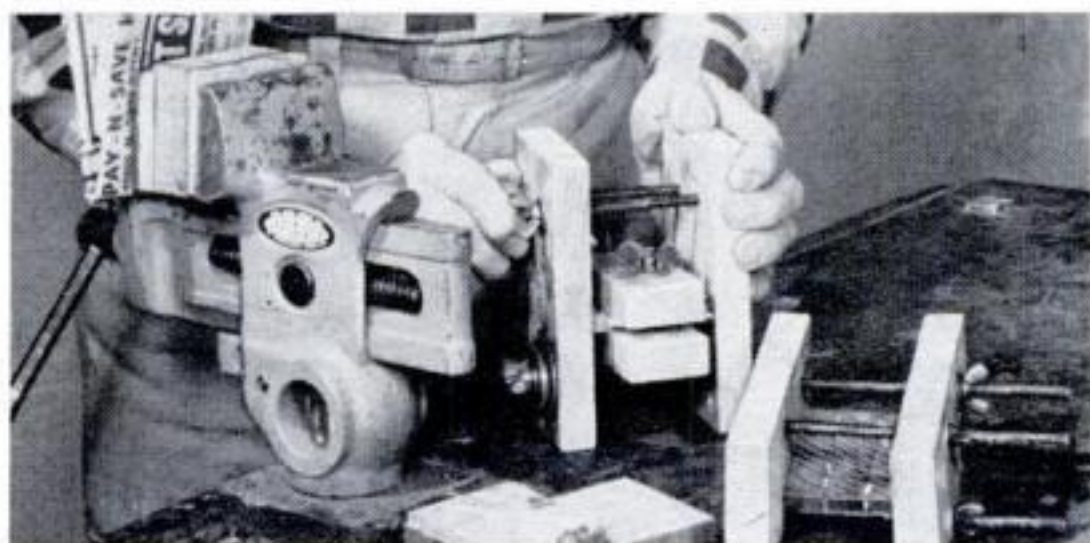


Shakers

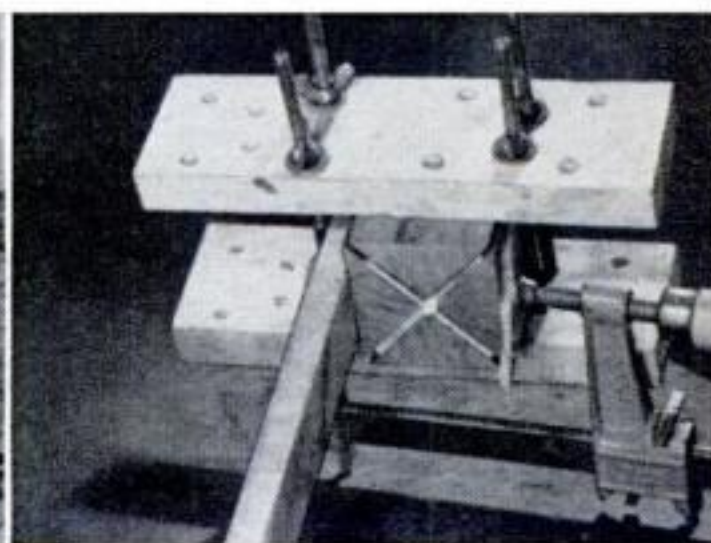
ONE style is built up of horizontal layers of contrasting woods, the other of vertical mahogany quarters separated by thin maple. If you wish, you can build up layers from smaller blocks by clamping them edgewise while scraps are clamped to the faces to keep the assembly from buckling.

For the radial assemblies, miter the blocks with a saw as accurately as possible and smooth with a sanding disk. To correct a poor fit, rest the piece on a board tilted by paper under one edge.

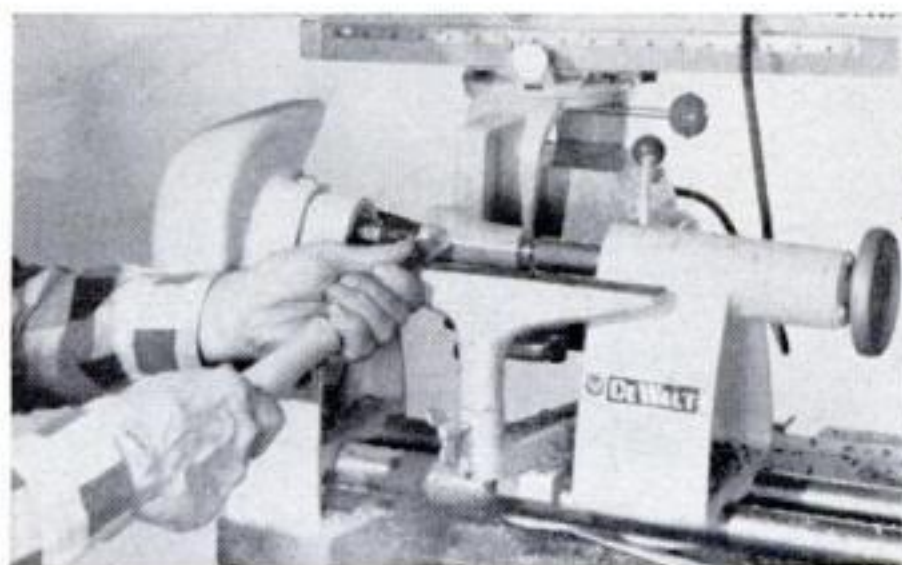
Often one block is all that needs reworking. In gluing, the mitered assemblies need even pressure from both directions with the clamp setup.



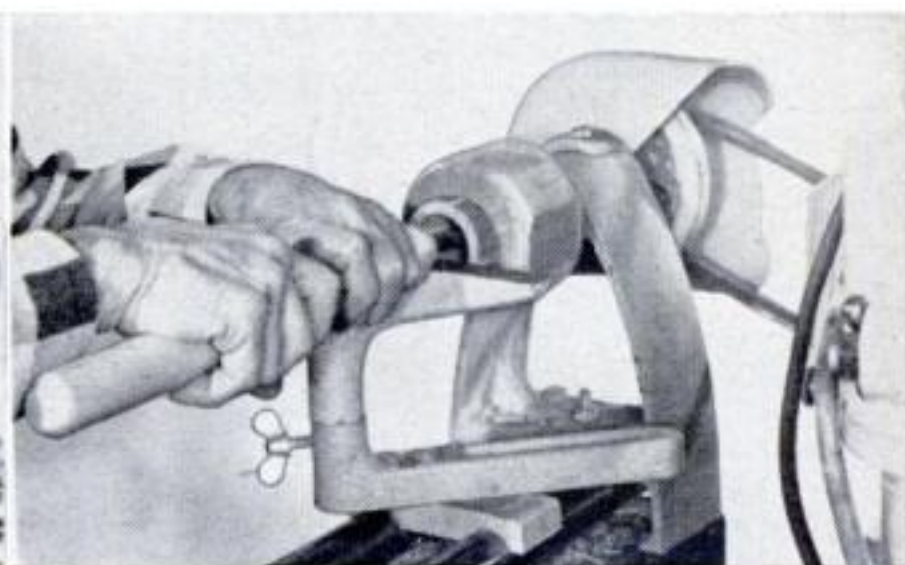
CLAMPING THE BLOCKS: In the picture at left, wood is being clamped for shakers made of horizontal layers. In the vise, an equalizing pad of paper is used against the outside jaw.



Other setups show use of clamps made of blocks and 6" carriage bolts. A small bar clamp is used in the photo at right for horizontal pressure on a radial-joint assembly.



TURNING A SALT SHAKER between lathe centers: After shaping the work and sanding it, remove it from the lathe and smooth the top end on a sanding disk. Then bore out the body.



TO BORE SHAKER, turn hole to fit shaker in wooden block mounted on a faceplate. Force shaker in and bore inside, roughing with narrow skew chisel, finishing with a round-nose.



The kids have a ball on this—

Homemade Merry-Go-Round

WHEN our little girl outgrew her play pen and took over the backyard, we sought a really novel piece of play equipment for her. We finally came up with this merry-go-round.

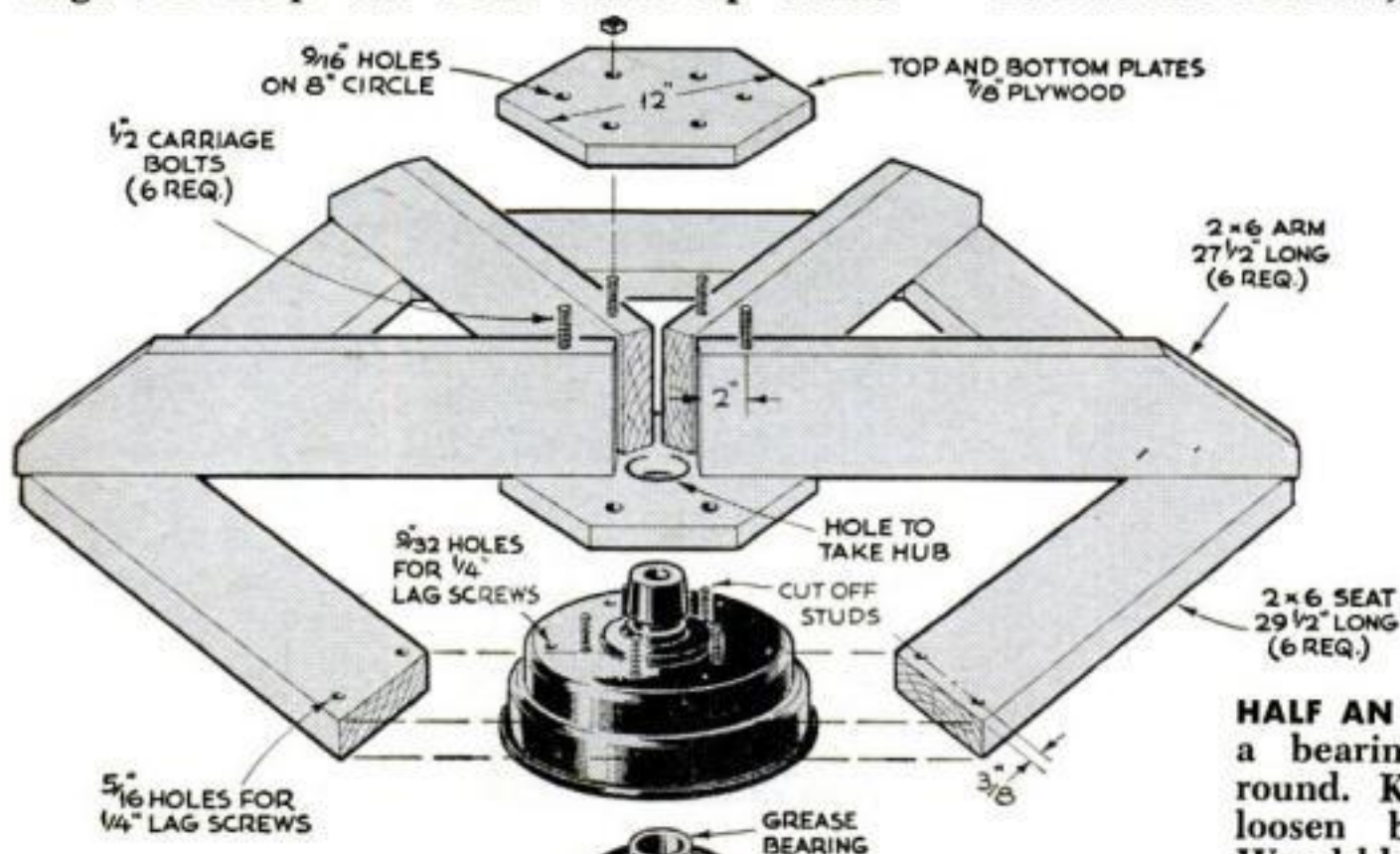
We put it together from a junked auto axle and two-by-sixes. Basically, it's half of a Model A Ford rear end, turned on its side, with a wood platform bolted to the brake drum.

To make it stable, we anchored the axle in concrete below the ground. This was done by embedding bolts in the concrete to match holes in the axle's housing. To keep the bolts lined up while

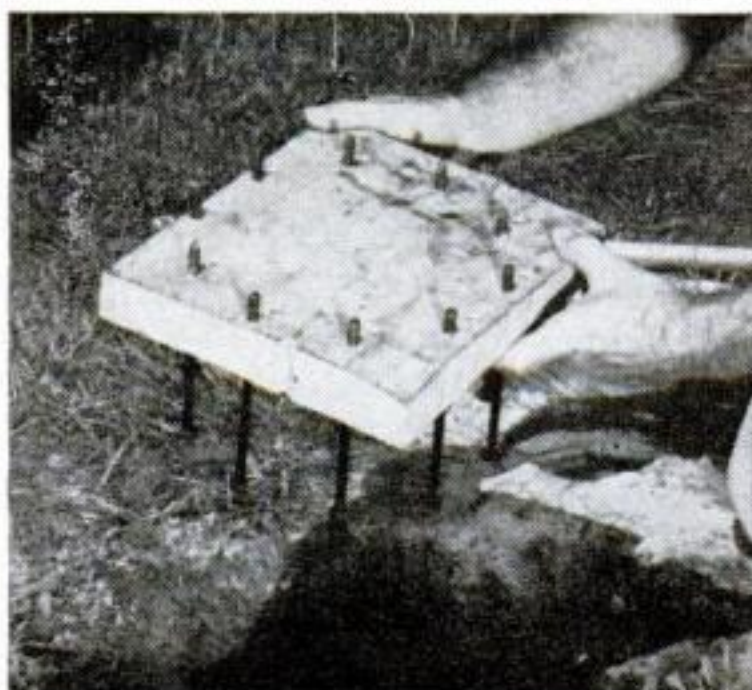
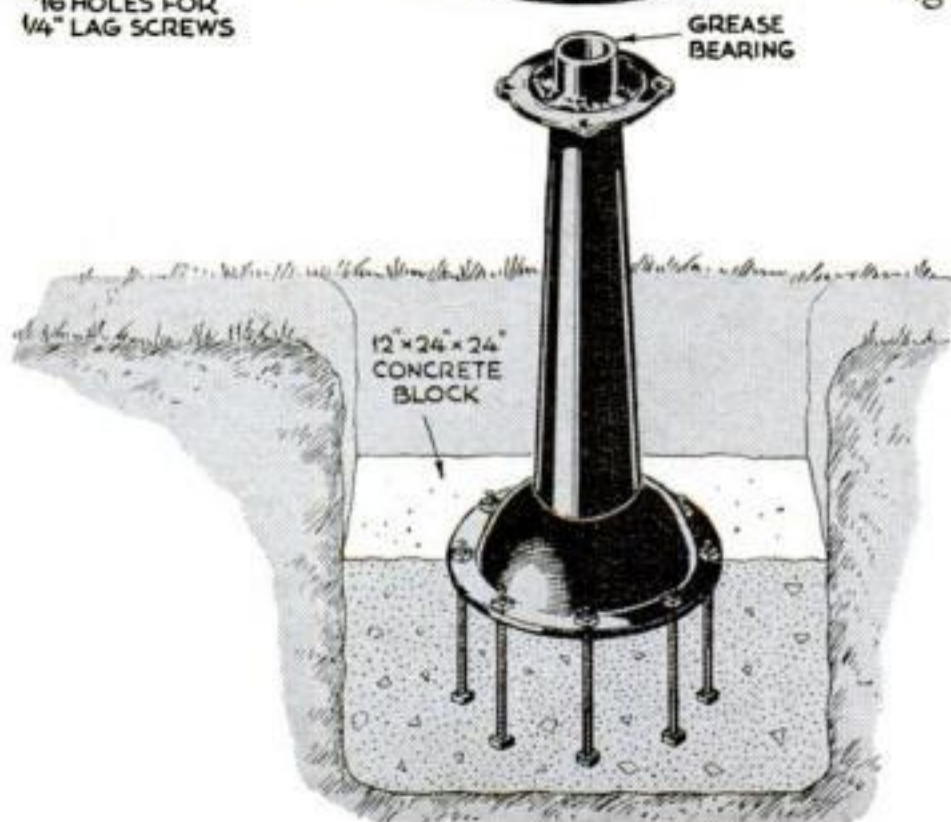
the concrete set, we ran them through a wood block drilled to match the housing. The axle protrudes 24" above ground.

The wheel studs on the brake drum had to be chiseled off and filed smooth. We then drilled six $\frac{9}{32}$ " holes through the drum to take $\frac{1}{4}$ " lag screws. It was easy to lay out a six-sided wood platform, using two-by-sixes held together by lag screws and carriage bolts.

We fastened the finished platform to the brake drum, gave it a trial spin, and then had to move fast to get out of the way of some very impatient children. —J. Patrick Powers, Boonton, N. J.



HALF AN AXLE on end provides a bearing for this merry-go-round. Kids' rough use won't loosen big concrete anchor. Wood block (below) kept bolts lined up while concrete set.



WHAT TO DO When You Can't Use a Tripod

By Jackson Hand

THE time comes when the picture must be made from a tripod—and it's impossible to get a tripod under the camera. Either there is no place for its legs to rest; or the best angle is higher than the tallest tripod; or it's lower than the shortest one; or the only right place for the camera is too close to a wall. There are times, too, when there might be room for the tripod, but no room left for the photographer.

While no one has devised a universal skyhook yet, there are a number of commercial gadgets that will help you hold your camera where you want it. There are monopods, belt-pods, chest-pods, stirrup straps, gunstocks, and a wide assortment of photo clamps. Only the clamps really anchor the camera; the others simply steady it.

Homemade clamps. But even if you are equipped with a selection of these chrome-plated goodies, there will still be times when you'll be stumped. Most of the clamps you buy are fairly limited in the size and kind of objects they can be clamped to. With a little ingenuity you can set up your camera anywhere once you make the de-complicating discovery that the tripod socket takes an ordinary $\frac{1}{4}$ " bolt—right off the shelf of any hardware store. It is a standard $\frac{1}{4}$ "-20 thread. Anything you can fasten a $\frac{1}{4}$ " bolt to, you can fasten your camera to.

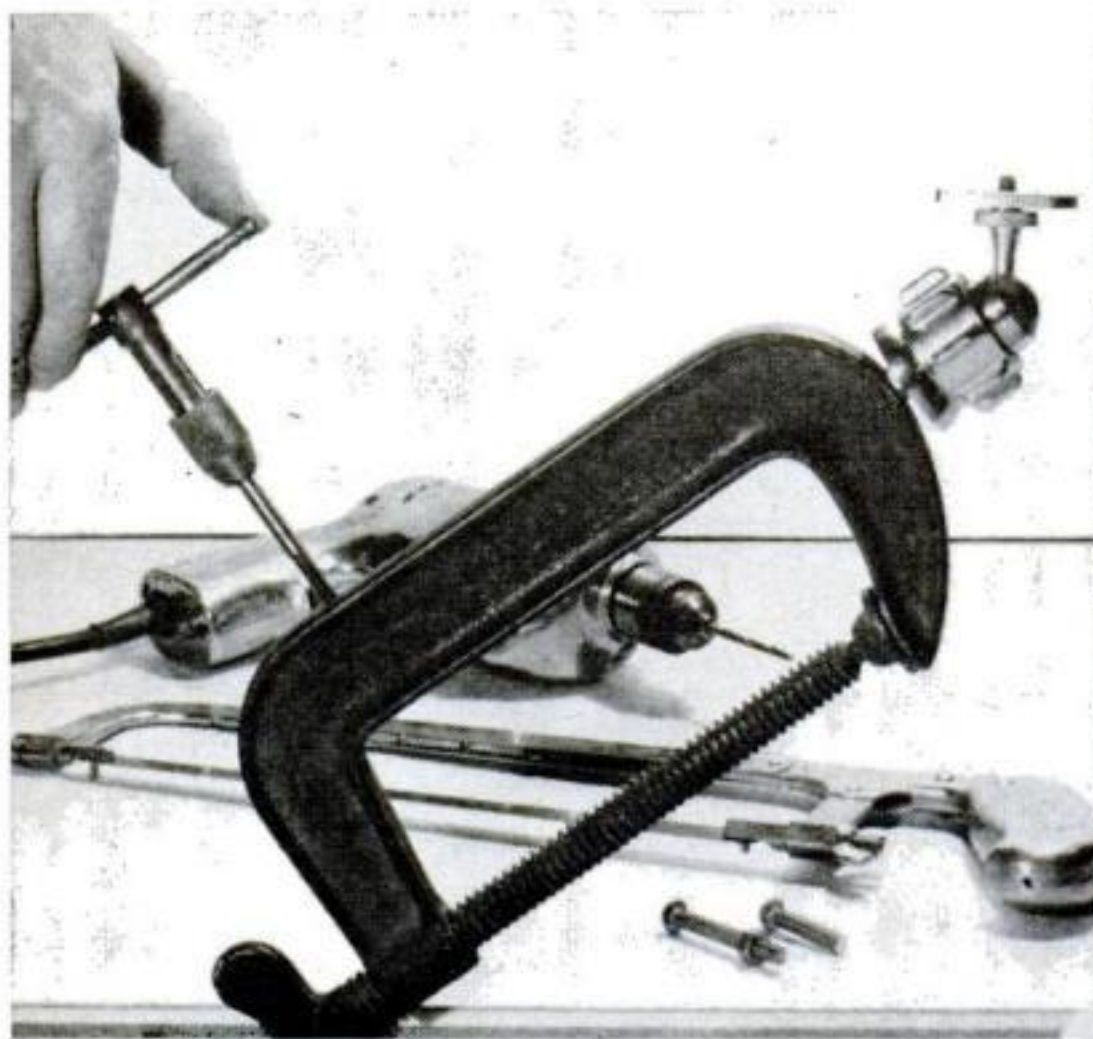
One of the simplest and most versatile devices can be made by mounting a number of threaded $\frac{1}{4}$ " studs on a standard C clamp. Choose a good-size clamp—say a 6" one. Drill holes at convenient points around the clamp frame with a No. 7 drill and tap with a $\frac{1}{4}$ "-20 tap. Run a nut all the way up on a $\frac{1}{4}$ "-20 machine screw about an inch long. Turn the screw into the tapped hole until it is tight. Then tighten the nut down against the clamp frame to lock the screw. Cut off the screw, leaving a stud about $\frac{1}{4}$ " long.

CAMERA SUPPORTS for vantage points higher or lower than offered by conventional tripods are easy to improvise by adapting C clamps and using materials you can pick up on location.

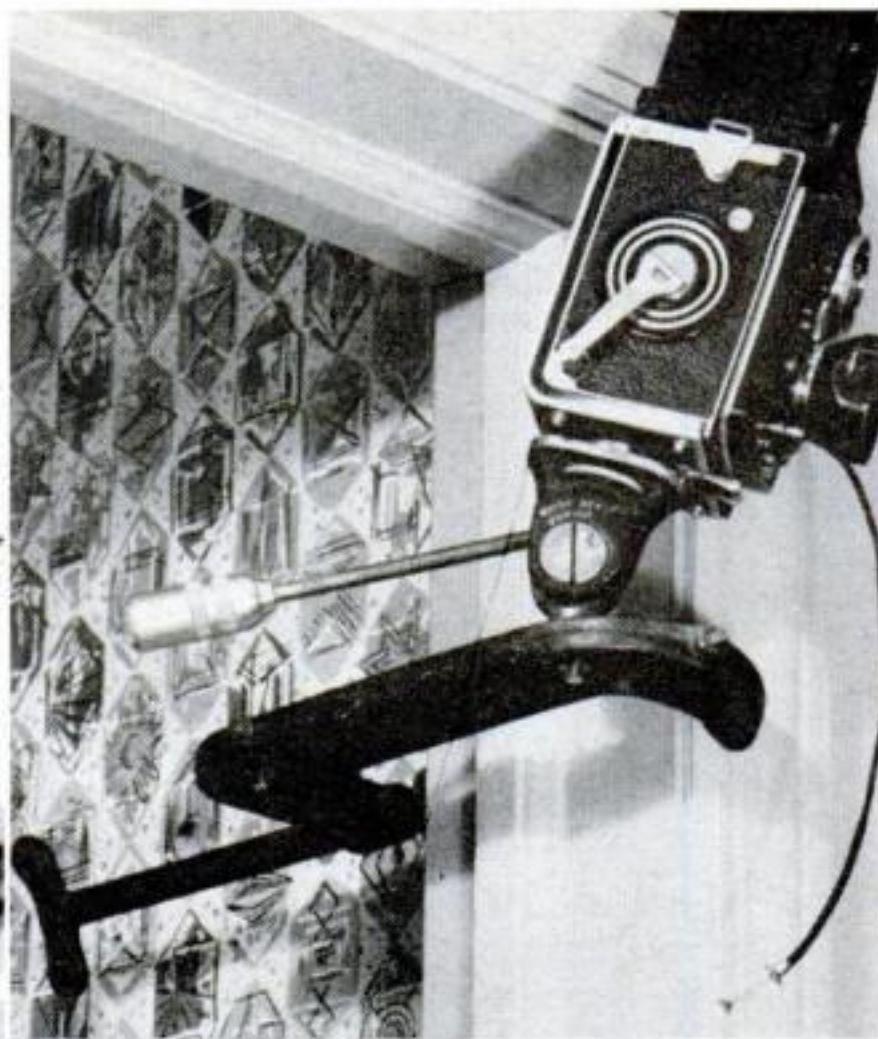


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Gadgets you can make from ordinary hardware anchor your



A PHOTO CLAMP YOU CAN MAKE offers complete flexibility with camera-mounting studs on the ends, back, and both sides. Studs are $\frac{1}{4}$ "-20 bolts with heads sawed off after installation.



A BIG CLAMP like this 6" one may seem bulky—but there is no substitute for wide reach for maximum utility. Ability to grip a door jamb, for example, widens choice of camera positions.

A big C clamp can be anchored to a lot of places, and when it won't make it, you can always clamp it to something that will—for example, a bar clamp. But there are situations where no type of clamp will work well. A telephone pole is one. The side of a barn is another.

Here's another trick that works perfectly in such situations. Make a "T screw" by fastening a $\frac{1}{4}$ "-by-3" machine bolt across the head of a $\frac{1}{4}$ "-by-4" lag screw. You can weld it or braze it. Run a nut up on the $\frac{1}{4}$ " bolt, screw your tripod head on the bolt, then tighten the nut

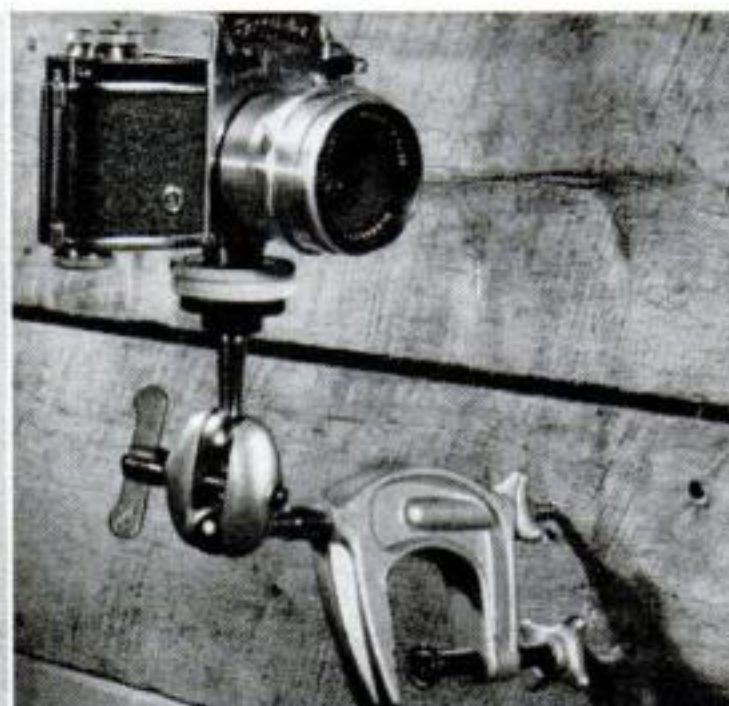
Tripod substitutes you can buy at a photo store may be the



CAMERA BELT-POD hooks over your belt with a strap around your neck. It gives better support than hand-holding, allowing slow shutter speeds even when you must move quickly.

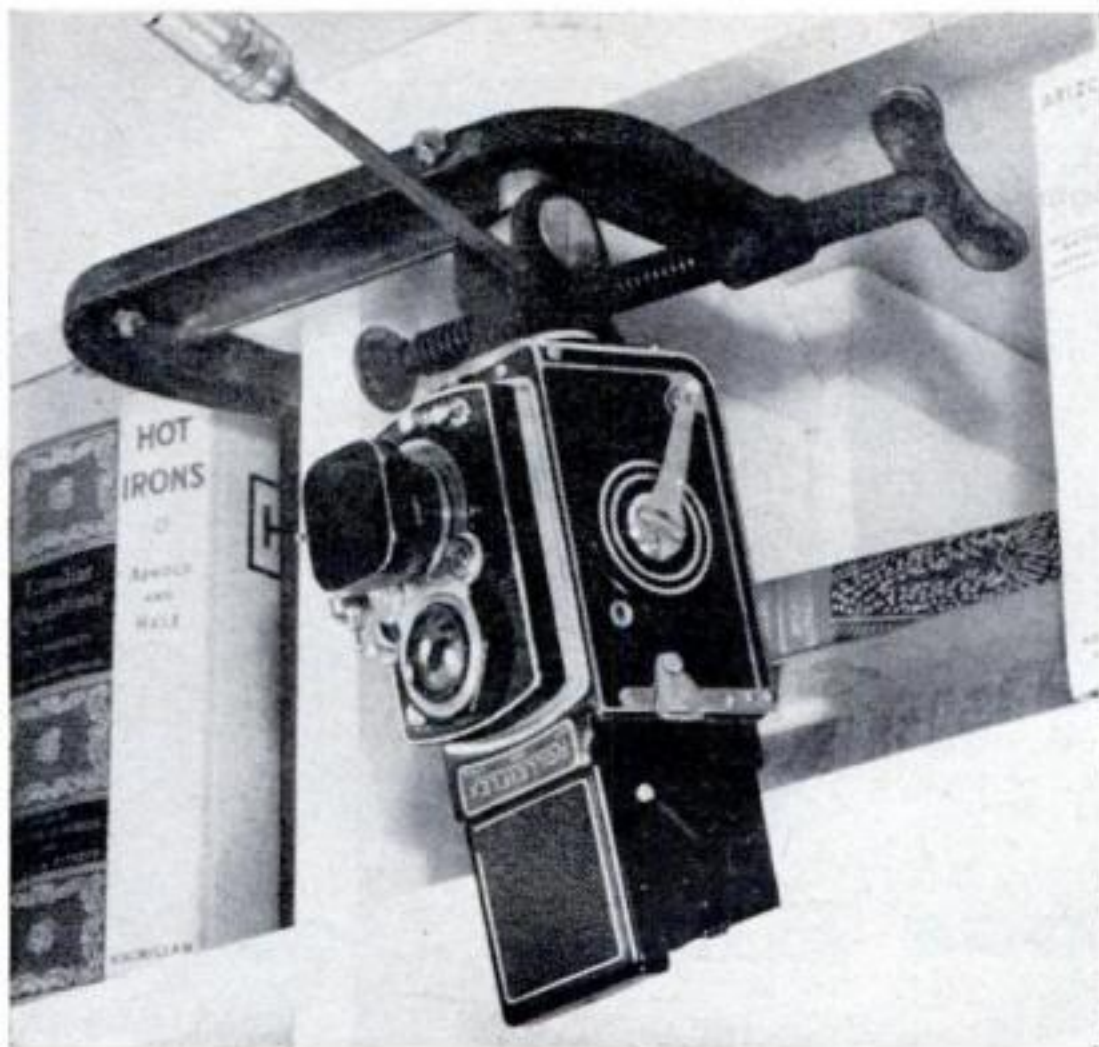


MONOPOD IS LONG ENOUGH to rest on the ground. Its one-point support can add enough stability to allow up to one-second exposures. You can work fast with it and it's easy to carry.



CLAMPOD IS STURDIER than most commercial clamps. In addition to the clamp, it has a wood screw point for fastening to any wooden surface. Handle of clamp screw makes added brace.

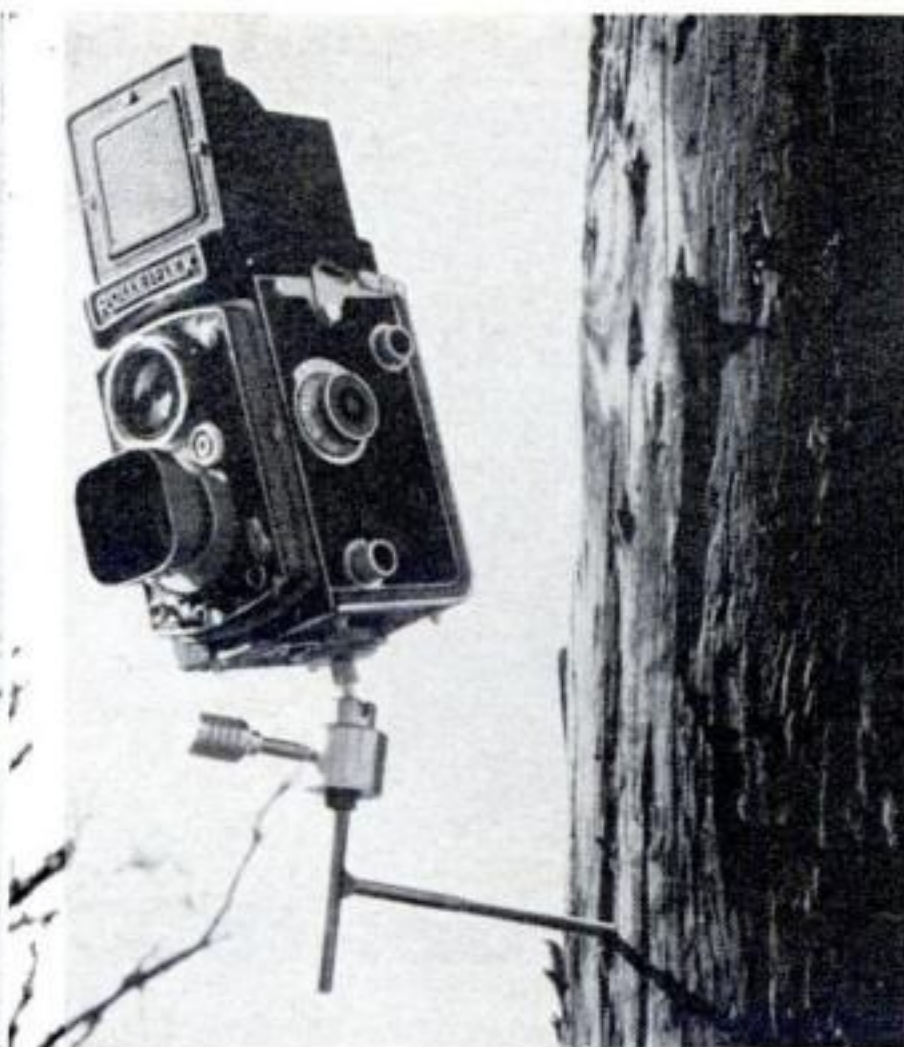
camera almost anywhere



A CEILING ANGLE is possible when you mount the camera upside down. It's a natural for reflex cameras, but will also give you a few extra inches of perspective with eye-level types.

against the tripod head to lock it. The lag screw can be turned into any wood object. The cross bar serves as a handle.

With the C clamp and the T screw in your bag, you are doubly equipped for anchoring your camera in space. For instance, the T screw goes into the end of



MIDDLE-OF-NOWHERE ANGLE is often easy with the "T-screw" mount. It's the handiest of all for outdoor photography. Turn the lag screw by hand into any convenient wooden anchorage.

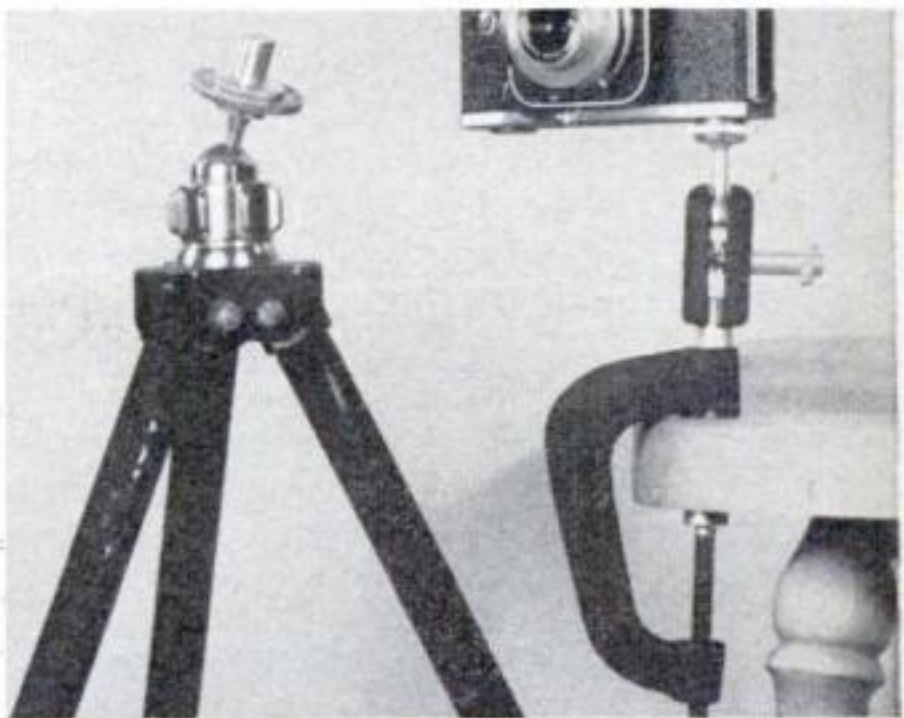
a long two-by-four which you extend into position, using the C clamp to hold it.

Although none of the camera-holding accessories is a complete substitute for a tripod, one or more tucked away in your bag will often save the day (and the picture) when you're traveling light.

answer for special needs



GRIP-POD WITH SHOULDER BRACE lets you use your camera like a rifle. This is good for steadying the camera when you are shooting fast-action pictures with a telephoto lens. Cable-release plunger can be squeezed like the trigger of a gun to eliminate shutter-release jar.

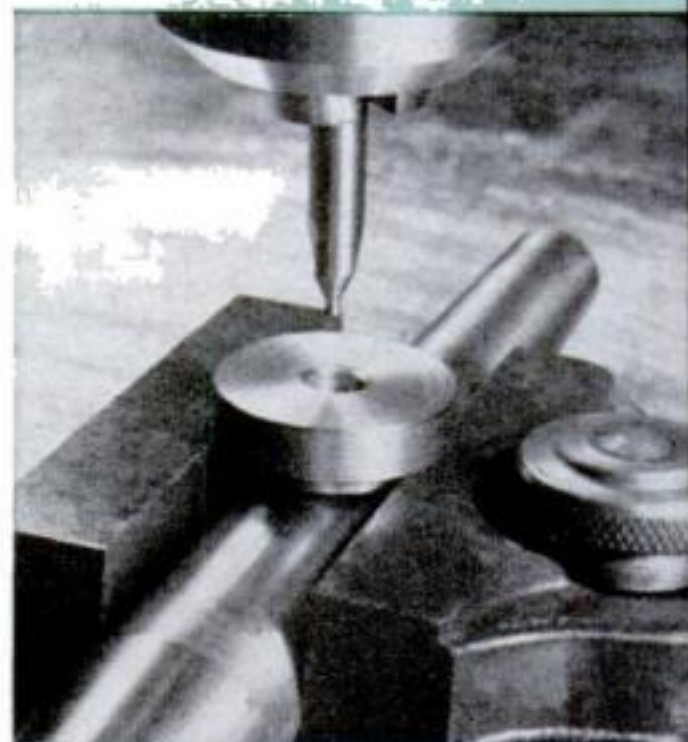


CAMERA CLAMPS are sold at photo stores in a variety of styles and sizes. Most of them are small, for easy stowage in a camera bag, but limited jaw opening restricts their usefulness. Model shown has quick-mount adaptor for switching easily between tripod and clamp.



SCRIBE CLOSELY SPACED parallel lines, using hermaphrodite calipers. Bent leg of the calipers bears on both the work and vise jaw. Pointed leg is adjusted so it can be presented accurately to the work surface. Make centerpunch mark between the parallel lines.

SIMPLE GUIDE BUSHING makes a precision drilling jig. Vise jaws grip both the workpiece and the smaller step of the guide bushing. After starting dimple is made with center drill, remove the bushing without moving the work and drill through with a drill of the proper size.



Accurate Cross Holes Don't

DRILLING cross holes in shafts by hit-or-miss methods often leads to endless trouble—the hole fails to line up with that in the mating part. Here are improved procedures and some auxiliary tools I have used to produce holes precisely on a diameter.

A combination center drill is best for making the starting dimple. It is short and rigid and the parallel section behind the conical point is ideal for fitting guide bushings. The small pilot portion of the

drill will start accurately in a centerpunch mark without leading off.

Accuracy sufficient for most purposes will be obtained if the centerpunch mark is located exactly on the high point of the shaft after the shaft is clamped in the machine vise. The first picture shows how. After the starting dimple is made with the center drill, follow with a drill for the correct hole diameter. The work should not be moved between the center drilling and final drilling.

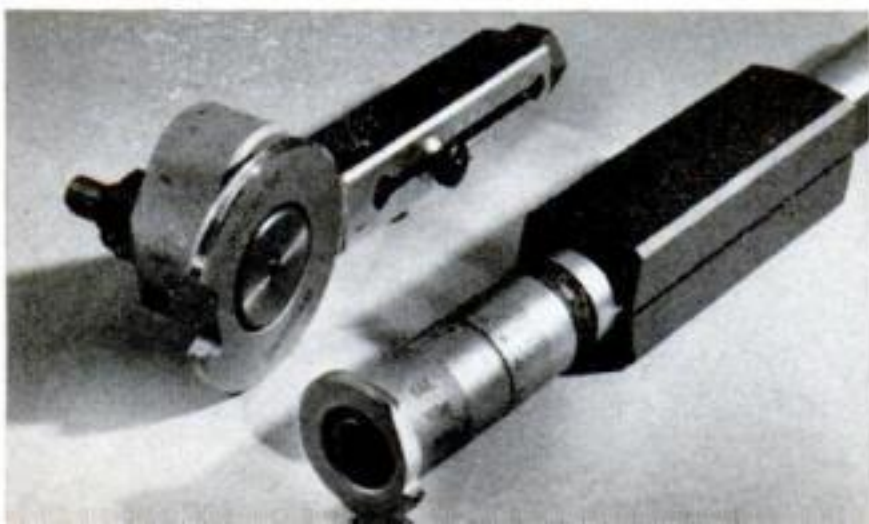
New Tool Cuts Slick Threads Without Fuss

THESE new thread-cutting tools for the lathe, imported from Switzerland, use tiltable cutting disks with a negative profile. The manufacturer claims several significant advantages over the usual pointed (positive profile) threading tool. The plunging method is used—no need to offset the compound. Both sides of the thread are machined simultaneously with the shavings flowing away from each other. The chips can't interfere and cause thread damage, as often happens with the conventional tool. When the cutter reaches the bottom of the thread, it re-

moves all burrs from the crest, giving a polished finish to both flanks and the crest. An accurate outline of the thread is automatically assured.

The other feature of these tools, the accurate setting of the tilt of the cutting disk, is rarely considered in ordinary shop practice. The cutter should be tilted slightly with respect to the vertical plane perpendicular to the axis of the workpiece, if it is to cut a true outline of the thread. The exact tilt depends on the pitch of the thread and the diameter. By setting the tilt accurately, much of the time wasted in the usual trial-and-test fitting of a thread can be saved.

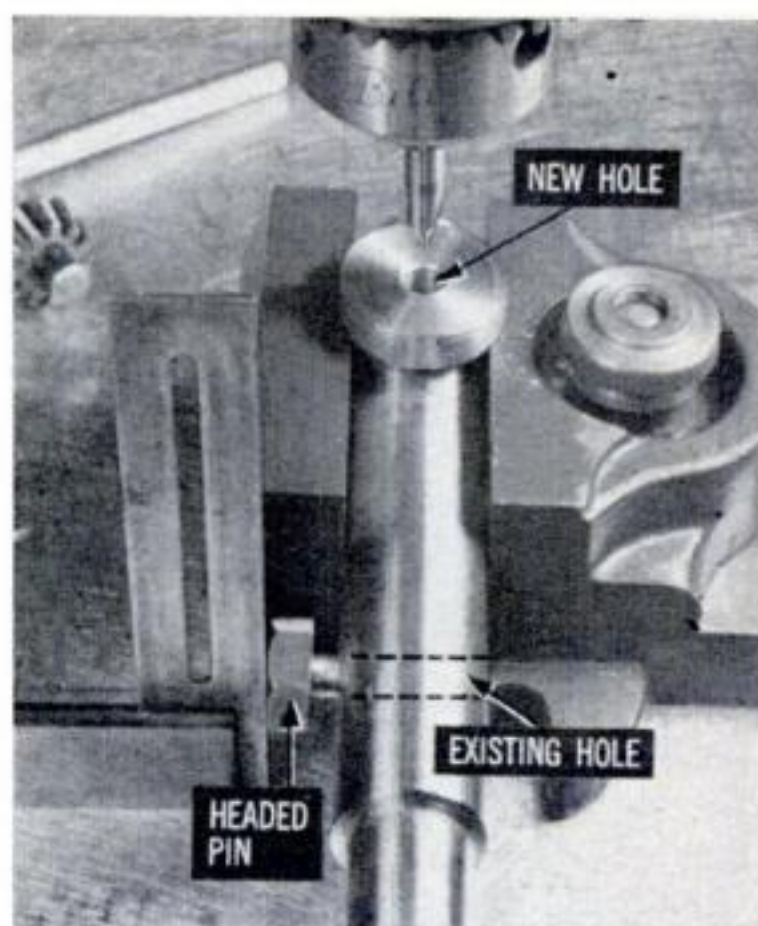
Thread-cutting disks for all standard threads and pitches are available for both external and internal tool holders. The importer is Acme Tool, 71 W. Broadway, NYC 7.—*Hubert Lockett.*





CROSS HOLE AT RIGHT ANGLE to another is easily and accurately made using an indexing pin you can make from an old bolt. Face off the pin head to a standard thickness to make it easier to find packing. Pin head bears on the fixed vise jaw for accurate indexing.

IF HOLES ARE TOO FAR APART, the head of the pin can be set exactly vertical using a square resting on the machine table. To locate the second hole at an odd angle to the first, substitute a protractor for the square and align the pin head with the protractor blade.



Just Happen

For greater accuracy or where there are several holes to be drilled, use the simple drilling jig shown in the second picture. The metal disk is turned with a stepped outside diameter and with a concentric central hole drilled through. The smaller outside diameter should be about .002" under the size of the shaft to be drilled. The central hole is a close running fit for the shank of the center drill.

When a pair of cross holes at right

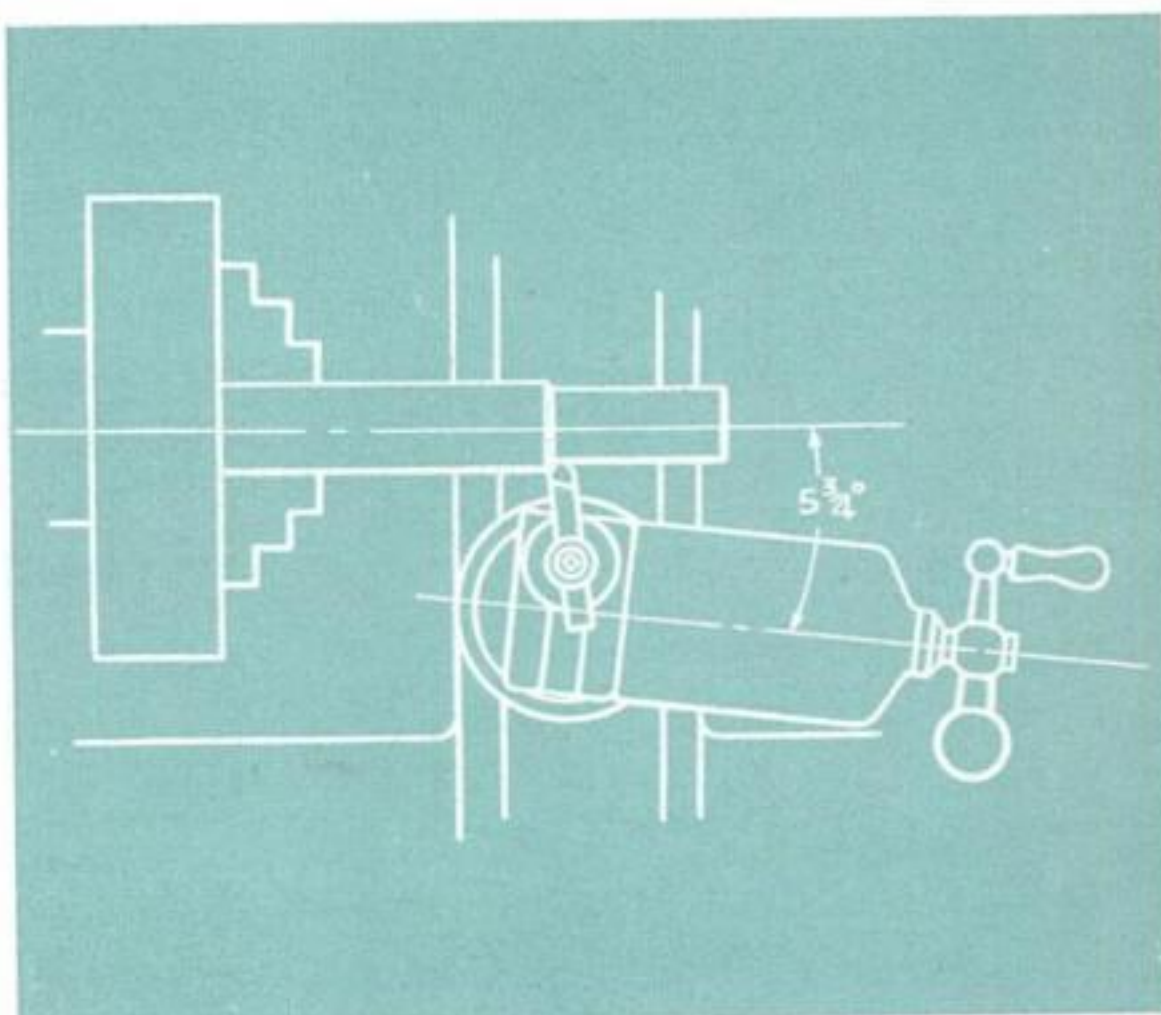
angle to each other are needed, the scheme shown in the third picture does this easily. Make a pin with a large head—the body of the pin should be a snug fit in the cross hole, the head faced off square with the axis of the pin. The pin shown in the illustration was made from an old hex-head bolt.

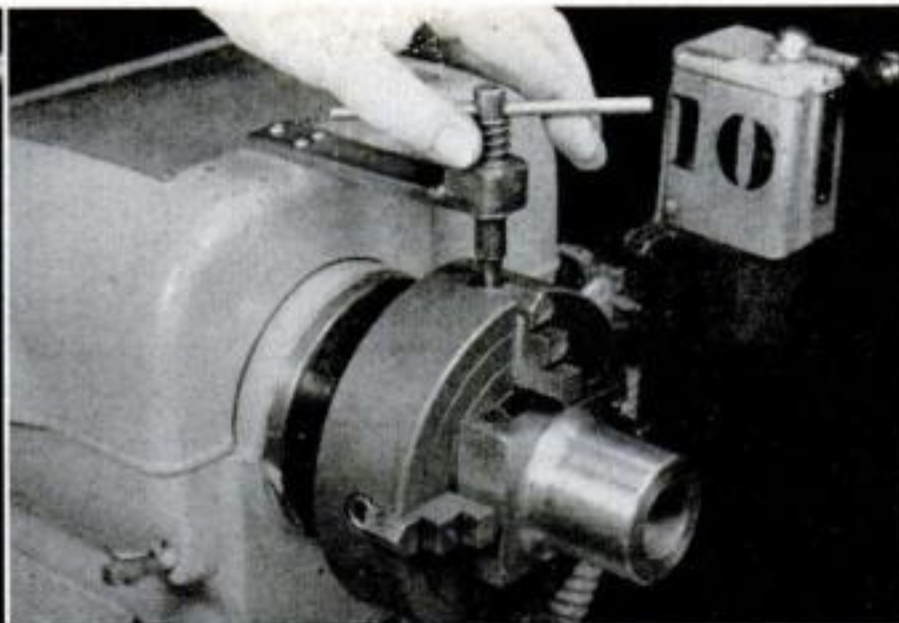
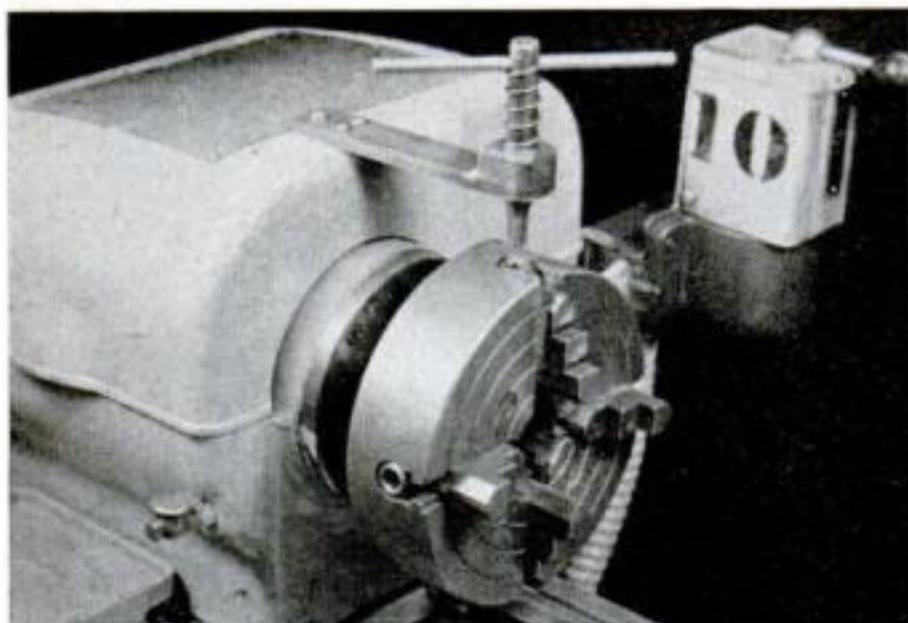
If the distance between the holes exceeds the length of the vise jaw, you can use a square to set the head of the pin vertical. If an odd angle is required, you can substitute a protractor for the square shown in the picture above.—C. T. Bower, London, England.

How to Split a Gnat's Eyelash

YOU'LL get more precise control of the depth of cut if you feed in with the compound set at an angle. When the angle with the center line of the spindle is $5\frac{3}{4}$ degrees, each .001" movement of the micrometer collar on the compound will give a depth-of-cut adjustment of .0001", or a ratio of 10:1. For coarser adjustments, an angle of 30 degrees will give a 2:1 ratio—each .001" on the micrometer collar corresponding to .0005" depth of cut.

For facing cuts, the angle is measured from a line perpendicular to the spindle.—F. Murray, Chicago.





Wrenchminder Stays on the Job

WITH a chuck-wrench support like this, the wrench will always be available when needed. The arrangement is also a safety feature, as the wrench can't be left in the chuck when the machine is started.

The wrenchminder is a simple bracket made of flat steel with a nut welded or otherwise attached to one end. Drill

through the nut with the proper size drill to make an easy fit on the body of the chuck wrench. Attach the bracket to the headstock gear cover with machine screws. A light helical compression spring, slipped over the wrench body under the T handle, pulls the wrench out of the chuck when it is released by the operator.

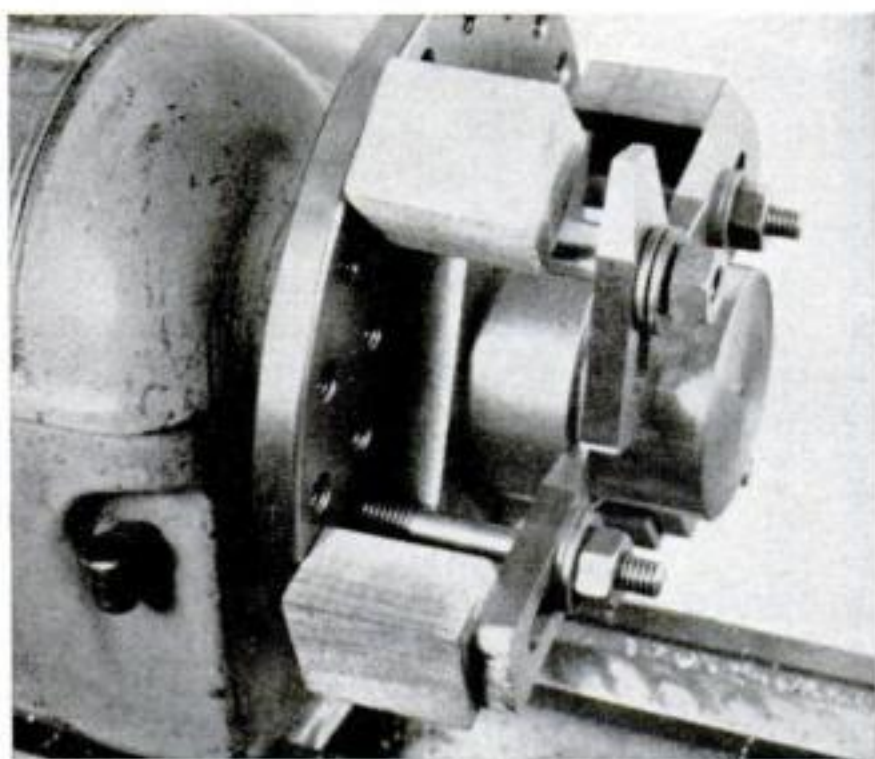


Third Hand for Machinists

SMALL button magnets, used as illustrated, are as useful as a third hand in holding heel blocks while you're setting up a job on the faceplate of a lathe. The magnets are seated tightly in holes bored in the hardwood blocks and adhere to the faceplate while the work is positioned and clamped into place.

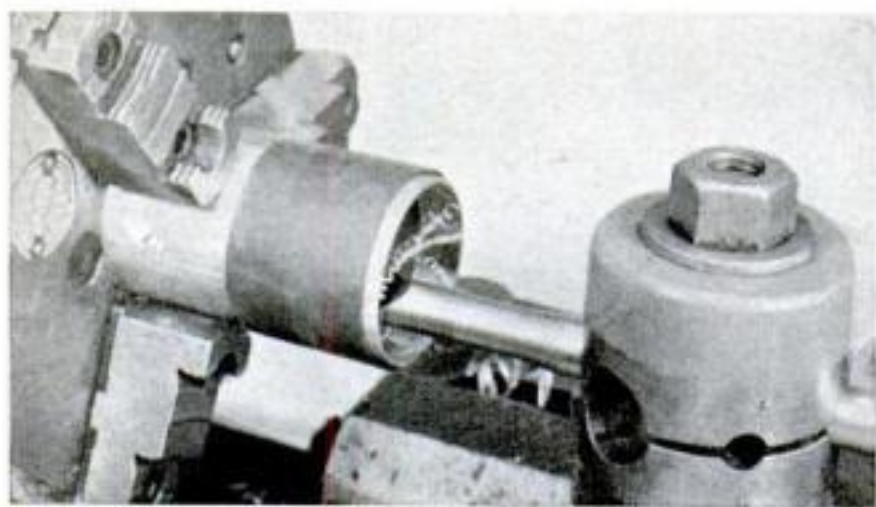
The hardwood blocks should be used end-grain-up. They are drilled to a depth sufficient to seat the magnets flush with the surface. A tight fit is necessary.

Wood blocks are usually preferred to metal ones for this kind of work. They



are more readily cut to exact length; and since they are slightly compressible, they hold the clamps with less slippage.

A smaller hole drilled the rest of the way through the blocks will let you punch out the magnets for use in different blocks.



Cut the Boring Chatter

GETTING a good finish is often difficult when boring thin-wall tubing, because vibrations set up in the workpiece cause chatter markings. A tight-fitting rubber sleeve stretched over the work will often dampen the vibrations enough to eliminate chatter. The one shown in the picture is a section from a bicycle inner tube.—H. J. Gerber, Stillwater, Okla.

When It's Time for a Puppy to Retire



Short Cuts and Tips

FROM PS READERS

A DISCARDED tire casing makes a cozy bed for a small dog or puppy. Place it on a wood base and fill the center with soft bedding material. For outdoor use in mild weather, you can tether the pooch by attaching a chain or leash to the casing.—*Ray Moore, Wellsville, Ohio.*



Newspapers Used for Mulch

I WAS always running out of mulch to keep down weeds and conserve moisture between rows in my garden. That was before I discovered that old newspapers make a good mulching base. I spread them out flat, overlapping sections at least five sheets thick. Then I scatter dirt on top, and pile on pulled weeds, lawn cuttings, leaves. For tomato and pepper plants (far right), I split old magazines halfway down the back and slip them over the stalks.—*J. Krill, North Lima, Ohio.*





7 Ways to Build a Garden Walk

By Paul Corey

SEVEN basic materials will solve just about any garden-walk problem you have. Each of these—flagstone, brick, concrete, asphalt, loose stones, wood, and soil-cement—can be used in a variety of ways or combined with one of the others to produce many special effects.

1 Flagstones are cocks of the garden walk. But unless you own a quarry, you'll find them expensive. Costs can be cut by using merely a row of stepping-stones—a style made famous by beautiful Japanese gardens.

Flagstones vary in thickness from $\frac{3}{4}$ " to 3". The heavier the better, especially if you plan to put them on top of the

FLAGSTONES are an old, old favorite

You have a choice of laying them casually on top of the ground, as above, or setting them into the earth, as at right. Single rows make the most of expensive flags without using a lot of them.



ground—they'll be more stable that way. Irregular-shaped slabs are the cheapest; neat square-cut ones are high in price. Colors range from a spectacular rainbow to more subdued buff, yellow, brownish red, and bluish gray.

For a formal garden walk, lay flagstones on a 2" base of sand between wood forms. The sand will permit you to compensate for different thicknesses. Sweep a dry mix of one part portland cement to two parts fine (plaster) sand between the cracks. Wet down the surface with a fine hose spray.

If you want to give your walk the "forever" treatment, lay the flagstones in a standard concrete-walk base. This is a 4" to 6" layer of gravel and a 2" to 3" layer of concrete between forms. Level up the flagstones, then use the dry-mix-and-water-spray method to fill the cracks.

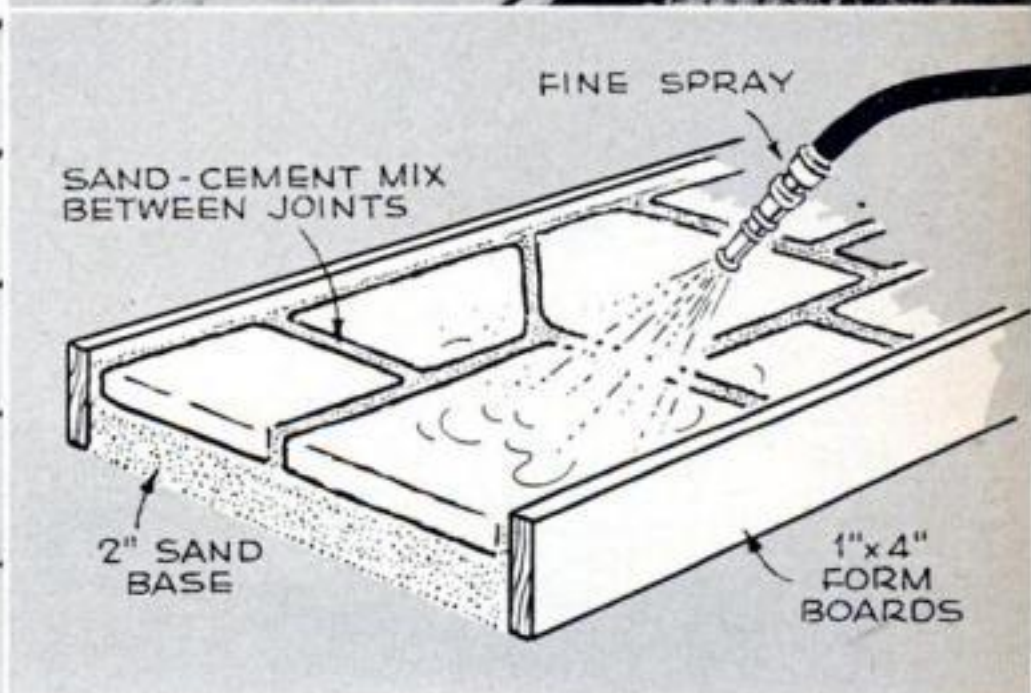
Any flat, manageable stone can be used. The next time you go fishing, look at the rocks in your favorite trout stream or along the lake or seashore. Maybe you'll find what you need for a garden walk—for just the hauling.

2 Brick is another favorite walk material. Common bricks measure roughly 4" by 8". Colors vary—red, orange, yellow, brown, gray, and blue-black. Roman brick and paving brick offer you different sizes and shapes to play around with.

Surface textures are not all alike. "Wire-cut" bricks have a rough look. "Sand-mold" bricks are smoother. "Clinker" bricks are over-fired and have interesting black patches and irregular faces.

New common bricks are the cheapest, around seven cents. Used bricks, favored by many landscape architects, cost around 8½ cents if you buy them cleaned. But you can get uncleaned ones for as little as a penny apiece.

You can lay bricks dry in a 2" bed of



A permanent path the easy way: Sweep a mix of sand and cement into the cracks; wet it down to form ready-made mortar.

Island hopping: Staggered flags add an Oriental touch to an informal walk, are also easier to walk on than a single narrow row of stones.

CONTINUED

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BRICKS
look good
underfoot
and will last
for years,
too

*For the casual look:
Used brick is rich yet
informal. Bought clean,
they're expensive,
but you can get
uncleaned ones for as
low as a penny apiece.*



sand and sweep sand into the cracks. Use loam to fill the cracks if you want grass to grow between the bricks; if not, treat the ground with a weed killer first.

Set bricks in a standard concrete-walk

base for greater permanence. Sweep a dry mix of cement and sand between the cracks and wet down. Follow the same technique as suggested for flagstones.

Bricks can be combined with other



**Four ways
you can make
CONCRETE
stepping
"stones"**

*Imitation flagstones
can be made cheaply by
casting concrete slabs,
then breaking them up,
as at upper left. Add
dividers to your form
(upper right) and you can
cast formal "slates."
Circular slabs can be
molded in barrel hoops
(lower left) or directly
in the ground (right).*



Form boards keep bricks even and level. Three sample patterns for brick are shown below.



Formal: This basket-weave design adds an elegant touch. Sand keeps the bricks from shifting.



Easygoing: That's the feeling you get with this random blend of brick and flagstone.



RUNNING BOND



BASKET WEAVE



HERRINGBONE

A BOARDWALK in the garden? Sure thing

Circular slabs give a woodsy warmth to garden steps and walks. These giants were chainsawed from redwood logs. Others, such as cedar, cypress, and most hardwoods, will also yield durable disks.



Old railroad ties sawed into bricklike blocks add a charm similar to old-time cobblestones.

Half-sliced logs, laid rounded side up, aid your footing on slopes too gentle to require steps.

Wood blocks set in grass are rustic, inexpensive, and surprisingly durable when decay-treated.



Small STONES and other loose materials



Two dazzling whites: Marble chips above, oyster shells below. They make striking ribbons through a garden.



Soft and springy, these oyster shells come in large bags ready to pour. Fine materials like this need boards to edge them.



A spectacular combination of color and texture in modern style: Redwood blocks set in a bed of white oyster shells.



Fancy effect from plain materials: Stones are simply 1"-to-2" pebbles or crushed rock dotted with islands of cast concrete.

materials, such as flagstone, for interesting and varied effects.

3 Concrete will give you an economical garden walk. It can also be made to duplicate the appearance of other types of walks, especially flagstone.

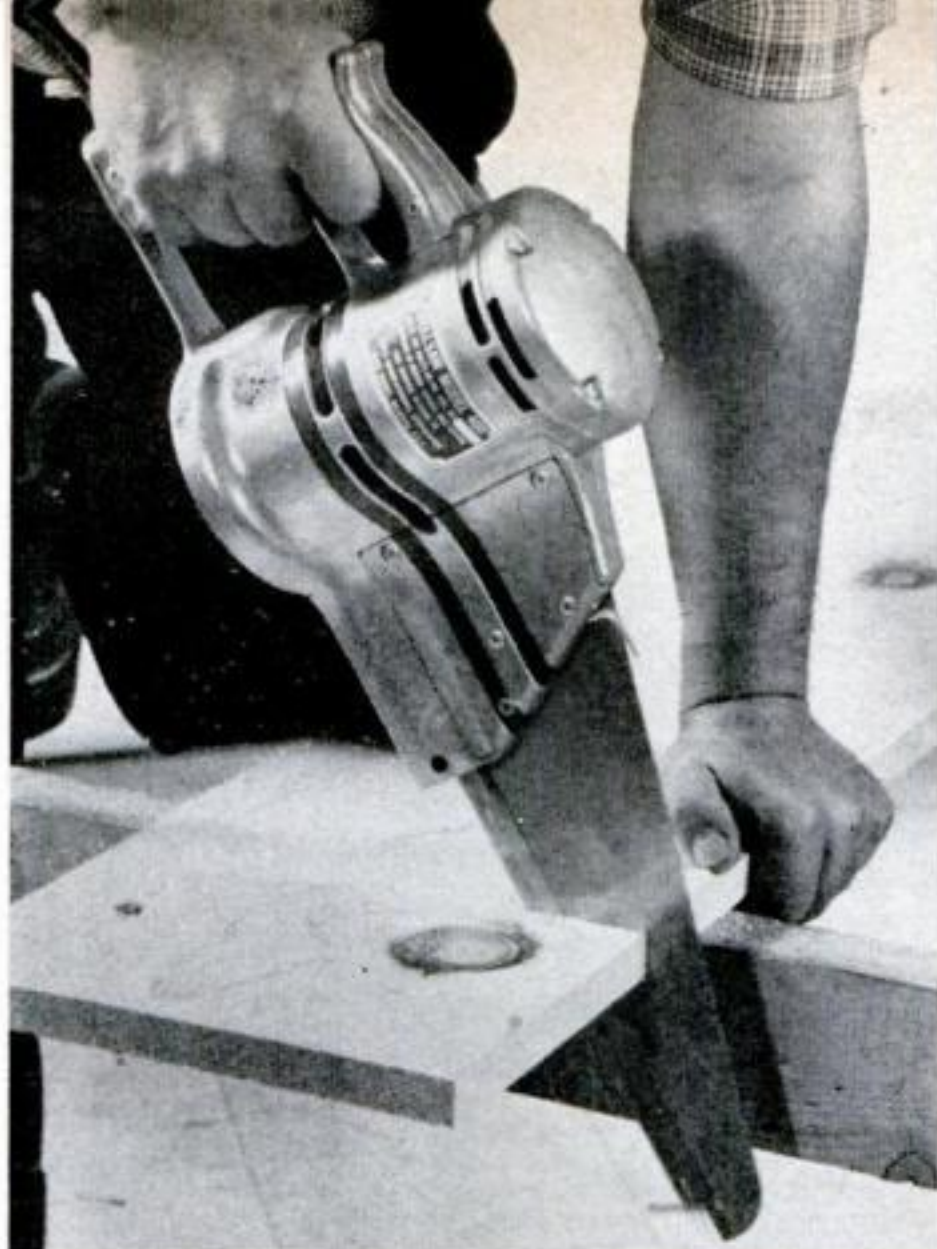
Build a wood form—20" by 30" is a good size—out of standard one-by-two lumber. Lay it on newspapers on a smooth surface and fill it with concrete. Use a mix of one part portland cement, two parts sand, and three parts gravel. Screed off the top and trowel it smooth.

When the slab is hard, remove the form, and crack it gently with a sledge hammer. It will break into interesting shapes that imitate flagstones. Add cement color to your mix and you can make slabs of different hues.

Partition off this form into different-sized openings and you can cast more-formal square and rectangular slabs. You can re-use the form as many times as you need to complete the walk. Oil the inside surfaces of the forms (old crank-case oil does fine) to keep the concrete from sticking to the wood.

Barrel hoops, large or small, will make good forms for concrete steppingstones. If you rub candle wax on the inside of the hoop, the hard slab will slip out like cake from a well-greased tin.

[Continued on page 240]



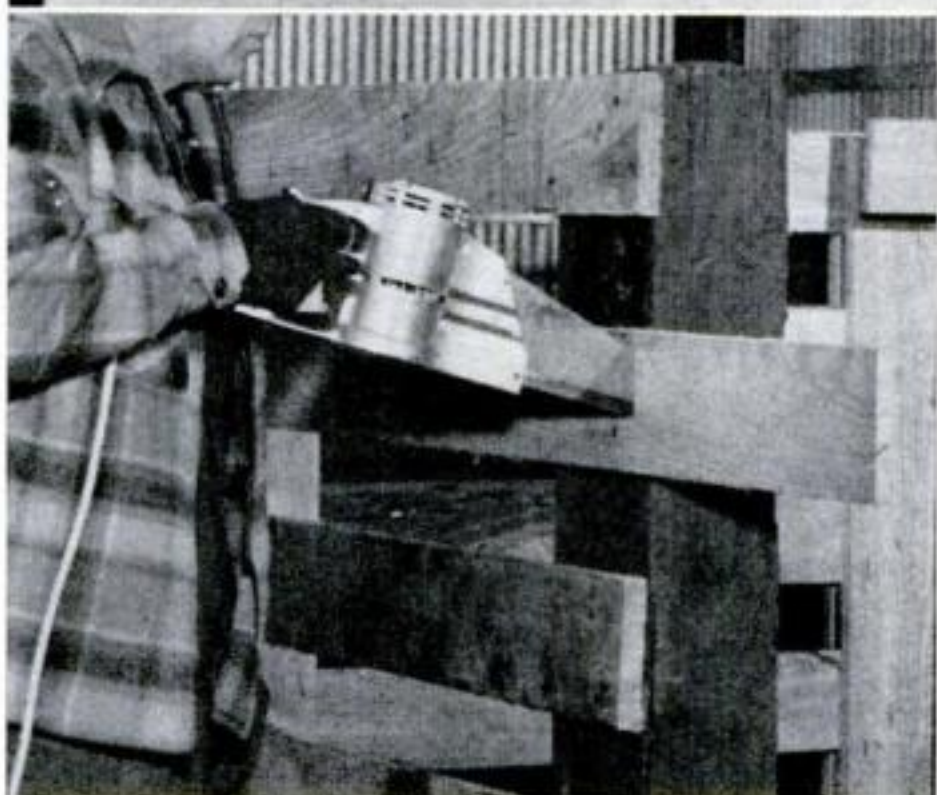
SHOP-USE REPORT on the **New** **Wellsaw** **400**

By Herbert R. Pfister

THIS electric saw looks, feels, and handles like your favorite old handsaw, and that's exactly what it is—a handsaw with a husky seven-amp motor hitched to it.

As an all-around cutting tool, it will do any handsaw job, plus many of the jobs of other types of portable saws. It makes a place of its own, though, by doing jobs they can't do, such as slashing through an 8"-by-8" post in less than a dozen seconds, cutting an opening in a wall—studs and all—and pruning trees. It can also be used, if you care, for manicuring cattle horns.

It is not a tool for the scroll-saw



WHEREVER YOU'D USE A HANDSAW, you'll use this handsaw-shaped electric saw. It takes the effort out of cutting wood, gets into places where other power saws can't reach.



PLUNGE CUT—starting a cut in the middle of a panel—is an easy job for the Wellsaw. Lay the saw flat against the panel (left photo) and draw it downward until it penetrates the

surface (center). Then increase the cutting angle until you're sawing straight into the panel as at right. Just saw through any studs or cats that appear in the line of cut.

CONTINUED

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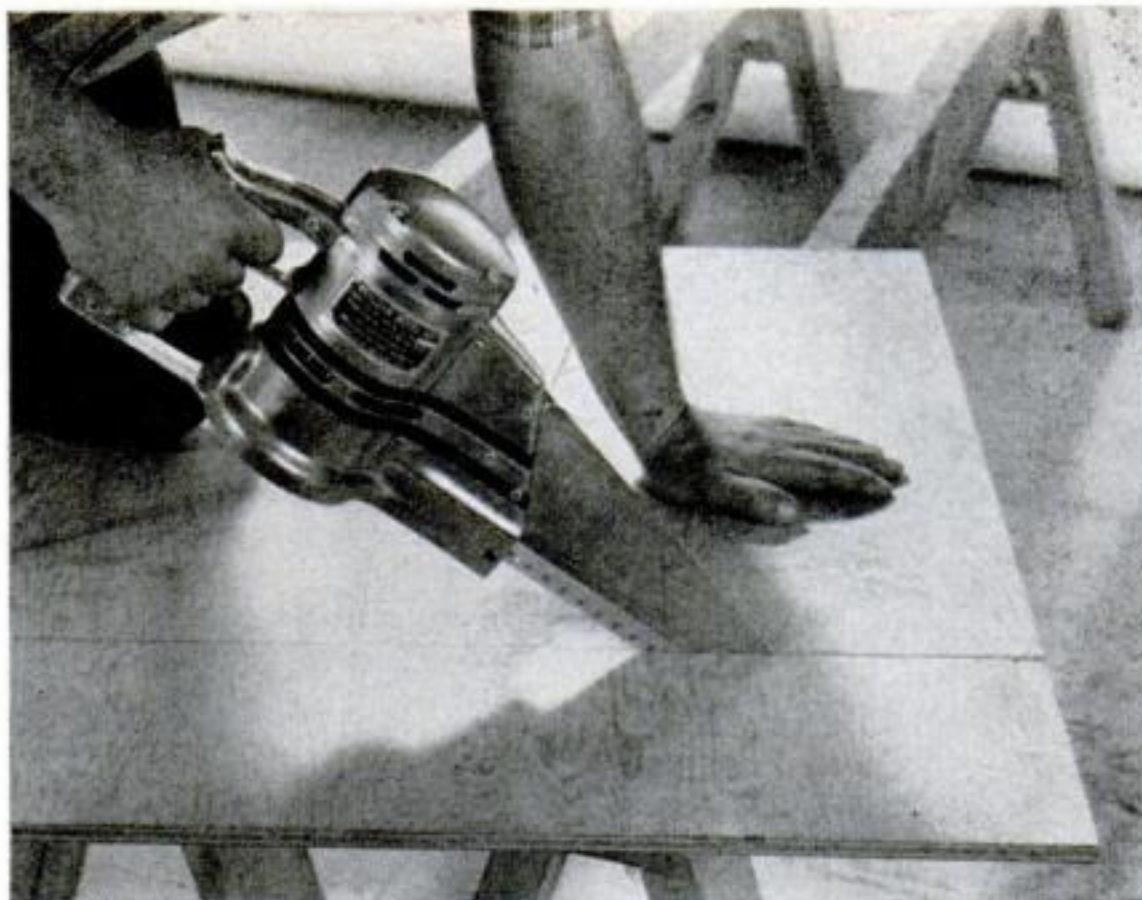
FOLLOW A CUTTING LINE just as you would with a handsaw—by eye. Photo at right shows clean, splinter-free cut made across the grain in plywood. Blower clears sawdust from work line.



COARSE BLADE makes short work of cutting firewood or posts up to 8" diameter. Saw cuts on both strokes without kick or pull. One hand can hold piece being cut.



RECIPROCATING MECHANISM drives blade at 8,000 cutting strokes per minute, yet the blade stops within 1½ seconds after the trigger is released.



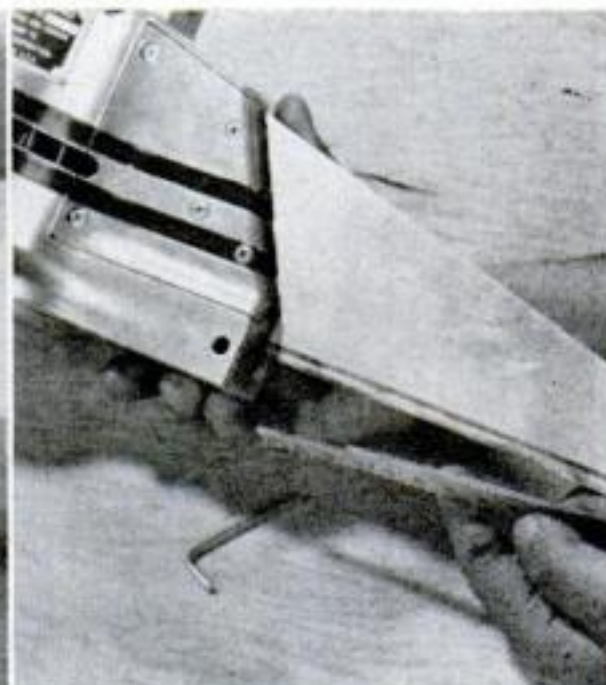
set, however. Its power and speed make you hold it at arm's length until you get the hang of using it. The blade cuts in both directions at 8,000 $1\frac{1}{8}$ " strokes per minute. It slices through shelving and other light work so fast that you may find yourself with eight pounds of vibrating saw hanging from your trigger finger before you realize the cut is finished. In this position, the exposed saw teeth seem to menace life and limb, though the blade stops moving within 1½ seconds after you release the trigger.

After a few trial cuts convince you that the tool won't bite, you'll very likely develop a fondness for it. It's a tool to consider if you're finishing an attic or adding a wing to your home.

The Wellsaw 400, priced at a little less than \$100, is made by the Wells Mfg. Co., 500 Service Road, Three Rivers, Mich. Replacement blades are available with eight, 12 or 16 teeth per inch at 95c each.



QUICK BLADE CHANGE makes the saw adaptable to any job in an instant. Use Allen wrench (clipped to motor housing) to pull blade out to limit of its travel (left photo). This aligns



setscrew with hole in housing (center). Loosen setscrew and slide blade off tongue at bottom edge of the backing plate (right). Reverse the procedure to install a new blade.

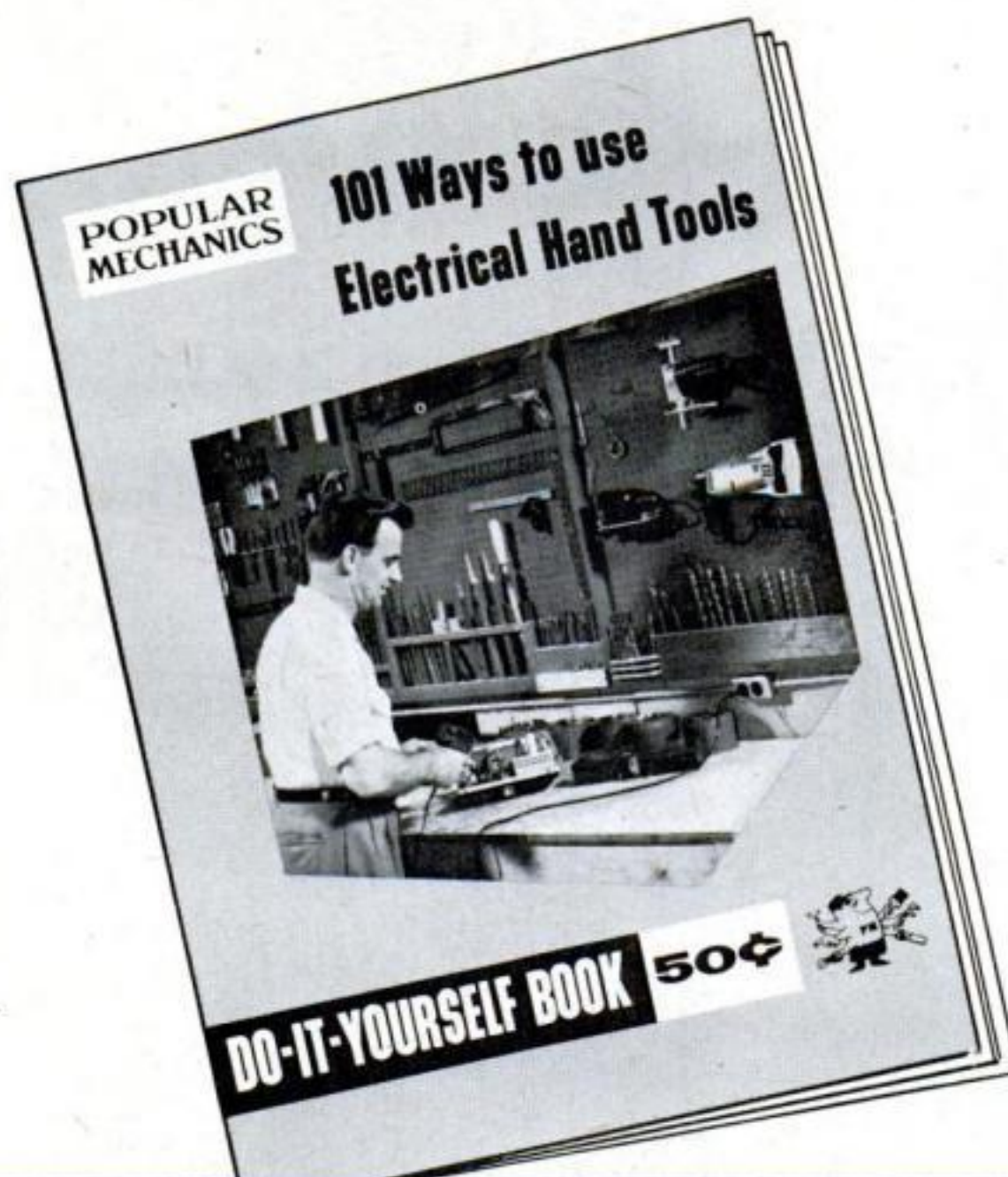


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WEN complete

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Your WEN power tool dealer will accept this coupon as cash for the purchase of one copy of the Popular Mechanics booklet "101 WAYS TO USE ELECTRIC HAND TOOLS." Limit one coupon per purchase. Void unless initially acquired in the manner provided or where prohibited, taxed or otherwise restricted or abused. Good only in U.S.A. Cash value 1/10¢.

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PRODUCTS, INC.,

5810 Northwest Highway, Chicago 31, Illinois

WEN**3/8" 2 SPEED POWER DRILL****HUSKY AND POWERFUL BUT NOT BULKY***Genuine Jacobs Geared Chuck***FULLY GUARANTEED**

Insert chuck in
Power Take-off
for high speed.

Insert chuck in
Power Take-off
for low speed.

MODEL 808**\$29⁹⁵****COMPLETE****OUTSTANDING FEATURES**

- Easy to change speed. No gear shifting.
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- Symmetrical modified handle with switch in center. Lock switch with a push trigger to release switch.
- Outstanding design features ball-thrust bearings on both spindles. Oversize oilite bearings PLUS an ingeniously wound motor that DELIVERS MAXIMUM TORQUE UNDER LOAD.

THE ONE DRILL WITH JUST THE RIGHT SPEED FOR ALL JOBS

HI SPEED—3000 RPM
Drill Through:

Steel, 1/16" to 3/32"
Wood, 1/16" to 3/8"
Alum., Brass, Copper,
1/16" to 1/4"

LOW SPEED—1000 RPM
Drill Through:

Steel, 3/32" to 1/2"
Wood, 3/8" to 2 1/2"
Alum., Brass, Copper
1/4" to 1/2"
Masonry, concrete to 1/2"

SPECIFICATIONS:

Universal 115V, AC-DC, 2 Amp. Motor. UL Approved. Heavy Duty Rubber Covered 6' Cord. Overall Length: 12 1/4". Height: 4 3/4" at Handle, 3 1/4" at Gear Box. Width: 2 1/2". Lustrous Silver-Grey Finish. Unit Weight: 4 1/2 lbs. Shipping Weight: 5 lbs.

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250 WATTS**

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\$995

MODEL 288

"BIG-HEAT" Electronic Soldering Gun with more than 200 watts of power. Unusually-designed tip reaches spots previously inaccessible. Highly efficient transformer delivers tremendous capacity, yet unit weighs only 2¼ lbs. Silver-plated tip heats in less than 5 seconds. Built-in spotlight. Length without tip 4½", with tip 9½". Built to last a lifetime. Special tip design also handles light-duty work. Lustrous ebony finish. High impact shatter proof case. 110-120 v. AC only.

MODEL 250K—SOLDERING GUN KIT

\$1595



The famous model 250 soldering gun in a sturdy heavy-duty metal carrying case. A specially plated 25-X-20 Feraloy Tip, a wonder-working cutting tip for vinyl and plastic, an ingenious flat tip for smoothing dented wood, five feet of rosin core solder, a $\frac{7}{16}$ - $\frac{3}{8}$ double end nickel plated wrench, and the handsome carrying case. 250 watts, 120 v. AC only.

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Complete HOME UTILITY KIT includes 199 Gun with long-nosed tip; tile-cutting and putty-removing tip; flat tip for removing dents from furniture and sealing waxed-paper bags; solder; and heavy-gauge metal box. A perfect gift-idea!



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MODEL 199— 130 WATTS

Famous lightweight "Quick-Hot" soldering gun heats in only 2½ seconds! Weighs only 1½ lbs., yet will handle practically any home soldering job. Handsome red finish.



\$7.95

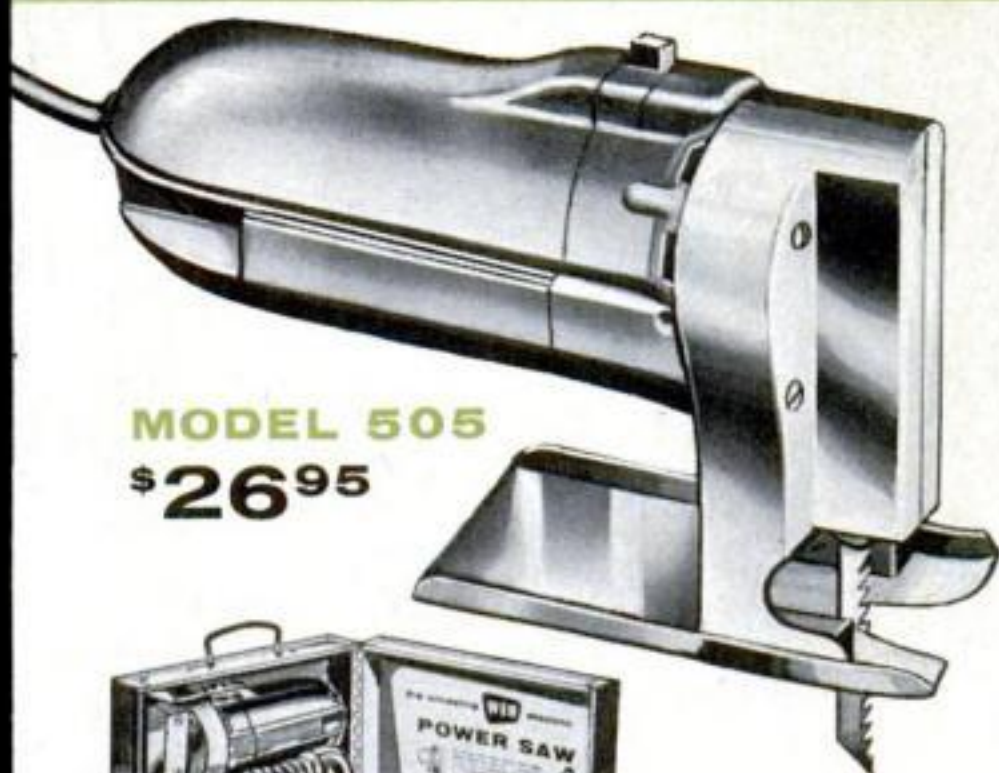
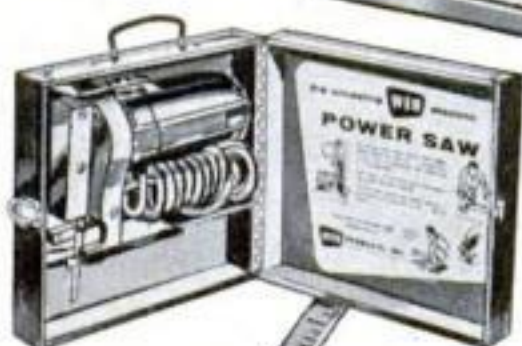
MODEL 100K

A complete kit, with unique book fold carton—comes with plastic tile cutting tip, extra long steel nosed long life general purpose soldering tip, 5' of rosin core solder, and the attractive two-color storage case housing the model 100 WEN Soldering Gun.



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WEN**ELECTRIC POWER SAW****THE TRULY UNIVERSAL POWER SAW FOR THE HOME
WORKSHOP—SAFE TO USE—EASY TO HANDLE****MODEL 505****\$26⁹⁵****ACCESSORY KIT INCLUDES EVERYTHING!**

- Heavy gauge metal box
- Assortment of 5 blades*
- Circle cutter
- Rip-Sawing attachment

PRICE**\$3.00**

Ideal for the cabinet shop—Display builders—Pattern Shop—Electricians—Plumbers—Radio Men—Does the work of a Rip Saw—Jig Saw—Band Saw. Operates as: Coping Saw—Crosscut Saw—Scroll Saw—Hack Saw—Keyhole Saw—Makes its own starting hole on inside cuts—Saw cuts Wood, Plastics, Metals, Composition Boards, Hard Rubber, Leather. Makes all type cuts—straight lines—curves—circles—intricate designs. WILL EASILY CUT A 2 x 4 IN SECONDS. Air stream blows sawdust off guide lines. Streamlined Easy Grip Cool Operating Handle. Well Balanced—Minimum Vibration—LIGHT WEIGHT ONLY 3½ lbs. Five assorted blades included.

SPECIFICATIONS:

Motor—115 v AC DC 1.8 Amp Rating. Switch—UL Approved Heavy Duty Slide Switch. Overall Length—6¾". Overall Height—less blade—5". Load Strokes per Min.—2650. Length of stroke—¾". Cord—6' Heavy Rubber—Molded Plug UL Approved.

(*) SAW BLADES INCLUDED:

- 1—Coarse wood cutting blade (7 teeth per in.)
- 1—medium wood cutting blade (10 teeth per in.)
- 1—fine scroll blade (14 teeth per in.)
- 1—non-ferrous metal cutting blade (18 teeth per in.)
- 1—extra fine blade for bakelite, ferrous metal, formica, etc. (32 teeth per in.)

If your dealer is out of the WEN Model 505 you may send check or money order to Wen Products, Inc., 5810 Northwest Highway, Chicago 31, Illinois. Be sure to enclose your Popular Science coupon. You will receive your tool post paid.

Your WEN Power tool dealer will accept this coupon as cash for a saw accessory kit at the time of purchase of a WEN Model 505 power saw at the nationally advertised price. (This accessory kit is not regularly delivered with the saw.)

Limit one coupon per purchase. Void unless initially acquired in the manner provided or where prohibited, taxed or otherwise restricted or abused. Good only in U.S.A. Cash value 1/10¢. Wen Products, Inc., 5810 Northwest Highway, Chicago 31, Illinois. This coupon expires June 1, 1960.

Mr. Dealer, all WEN tools purchased by you for this campaign are plainly labeled PR models. These PR models are packaged with the extra items promised. You need only accept this coupon and destroy it.

**THIS COUPON
WORTH****\$3.00****WEN****PRODUCTS, INC.,**

5810 Northwest Highway, Chicago 31, Illinois

Your WEN tool dealer will accept this coupon as cash for five extra packages of sandpaper at the time of purchase of a WEN Model 202 Electric Sander at the nationally advertised price. (This sandpaper is in addition to that which is regularly delivered with the sander.)

Limit one coupon per purchase. Void unless initially acquired in the manner provided or where prohibited, taxed or otherwise restricted or abused. Good only in U.S.A. Cash value 1/10¢. Wen Products, Inc., 5810 Northwest Highway, Chicago 31, Illinois. This coupon expires June 1, 1960.

Mr. Dealer, all WEN tools purchased by you for this campaign are plainly labeled PR models. These PR models are packaged with the extra items promised. You need only accept this coupon and destroy it.

THIS COUPON
WORTH

\$1.00

WEN

PRODUCTS, INC.,

5810 Northwest Highway, Chicago 31, Illinois

POWERED WITH THE NEW SUPER-POWER MOTOR

- QUIET OPERATION from vibrator motor
- SMOOTH ACTION—no whip—no bounce—minimum vibration on users hand
- POSITIVE STRAIGHT LINE ACTION sands WITH the grain—all the way into inside corners
- SELF TIGHTENING CLAMP pulls, tightens paper—locks into position
- LARGE SANDING AREA—a full 13¾ sq. inch ALL working sanding surface
- LIGHTWEIGHT, only 2½ lbs. makes overhead jobs less tiresome
- POWERFUL high speed COOL operating motor
- STREAMLINED functional design comfortable grip fits in the palm.
- HEAVY DUTY positive action slide switch
- COLOR of all plastic case — UTILITY BLACK
- FULLY GUARANTEED



MODEL 202
ELECTRIC SANDER POLISHER
only **\$13⁹⁵**

SPECIFICATIONS:

- 100-120 V. 25 watts, 60 cycles AC only
- Speed: 14,400 strokes per minute
- Throw: approx. ⅛" under load
- Sanding Area: 2½" x 7½"
- Unit Weight: 2½ lb.
- Size: 5⅝" long x 2½" wide x 3¼" high
- Cord: 6-ft. UL approved Prenex cord with molded plug
- Individually packed in self-display box

If your dealer is out of the WEN Model 202, you may send check or money order to Wen Products, Inc., 5810 Northwest Highway, Chicago 31, Illinois. Be sure to enclose your Popular Science coupon. You will receive your tool post paid.

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WEN

ELECTRIC SANDERS

OUTSELL ALL OTHERS!

Your WEN power tool dealer will accept this coupon as cash for an *extra* set of seven saw blades at the time of purchase of a WEN Model 909 Sabre Saw at the nationally advertised price. (This set of blades is in addition to those regularly delivered with the saw.)

Limit one coupon per purchase. Void unless initially acquired in the manner provided or where prohibited, taxed or otherwise restricted or abused. Good only in U.S.A. Cash value 1/10¢. Wen Products, Inc., 5810 Northwest Highway, Chicago 31, Illinois. This coupon expires June 1, 1960.

Mr. Dealer, all WEN tools purchased by you for this campaign are plainly labeled PR models. These PR models are packaged with the extra items promised. You need only accept this coupon and destroy it.

THIS COUPON
WORTH

\$3.40

WEN

PRODUCTS, INC.,

5810 Northwest Highway, Chicago 31, Illinois

AMAZING—FIRST AND ONLY PORTABLE ELECTRIC SAW TO GIVE YOU ALL THESE FEATURES!



Model 909

only **\$44⁹⁵**

COMPLETE

Look what you get! Rip guide, circle cutter, 45° tilting base plate and 7 blade complement—the right blade for every job!

cuts a 6" board or 6" log yet cuts any pattern, too!

cuts all metals up to 1/2" steel and 2" pipe!

cuts 4 x 4 at 45° . . . fine pattern work in most any material, including sheet metal and sheet steel!

does everything a pattern saw will do . . . out-performs a circular saw . . . works as band saw or nibbler, too!

beautifully balanced, lightweight, smooth running . . . completely safe!

makes cuts only a chain saw could—until now!

Motor: 110V 6 amp AC-DC. Length: 8". Width: 7". Height: 7 1/2". Weight: 6 lbs. Powerful 1/2 H.P. motor delivers 3400 strokes per minute; length of stroke: 1". 3-wire 8 ft. cord with adaptor. Heavy duty roller and oilite bearings. UL listed under industrial classification.

If your dealer is out of the WEN Model 909, you may send check or money order to Wen Products, Inc., 5810 Northwest Highway, Chicago 31, Illinois. Be sure to enclose your Popular Science coupon. You will receive your tool post paid.

WEN

1/2 HP SOUPED-UP SABRE SAW

... CUTS 4 x 4 AT 45° ... 6" LOG

... FINE SCROLL WORK ... COMPLETE SAFETY

**What You
Should
Know About**

**materials
file**

Buying Grass Seed



KENTUCKY BLUEGRASS



RYEGRASS

MOST home lawns are best grown from a mixture of grass seeds—for a good reason. Even on a small plot there are often varying conditions of sun, shade, soil quality, drainage. No one grass will thrive under all these conditions. A blending of seeds is based on the shotgun principle: Where one type won't grow, another will.

Since it is impractical to make your own mixture, you have to take what is on the market in packages or bags. If you know something about lawn grasses, however, you can shop around until you find what you want.

A mixture of two or three *permanent* lawn grasses, such as Kentucky bluegrass and red fescue, is considered most desirable by the U. S. Department of Agriculture. These permanent grasses should make up at least 80 percent of the mixture. In some areas, colonial bentgrass does well (see map, next page), but it requires more care.

The cheapest mixtures on the market may give you a quick growth of green—

Cheap mixtures are no bargain

SO-CALLED ECONOMY MIXTURES must necessarily contain a high percentage of "trash" seeds in order to sell at a low price. They are a waste of money if you want to build an attractive and permanent lawn. The hayseeds they usually contain in great quantity belong in a hayfield. They won't make a clean-cut emerald-carpet setting for your home.

Another reason why you don't get your money's worth, pound for pound, is illustrated in the magnified photographs above. Kentucky bluegrass contains more than 2,000,000 seeds to the pound; ryegrass only about 250,000. When buying lawn seed, remember that it is the square-foot coverage that counts, not the weight. Check bargain buys carefully—read the label.

CONTINUED

but not a lasting lawn. They usually contain a high percentage of temporary, or nursegrasses (ryegrass, redtop), that germinate (start growing) fast but die out the following year, leaving bare spots. A good mixture should not have more than 10 percent of these temporary grasses.

For your protection, state and federal seed laws require the listing of not only all ingredients in a mixture, but of germination percentages, date of test, and other information. In many cases, this is printed in small type.

The importance of being able to interpret this information is stressed by Dr. Robert W. Schery, director of The Lawn Institute, Marysville, Ohio. "Not only is about one-third of the seed sold as 'lawn seed' essentially useless, but another third is ill-designed for permanent turf even though containing some of the desirable species."

How to evaluate a lawn-seed mixture

Kentucky bluegrasses. These do best in open, sunny areas, and need fairly good soil. They spread underground by means of rootlike stems, so that a few original plantlets can eventually colonize a whole lawn should other grasses die out. The parent stock, natural Kentucky bluegrass, is a good mainstay for most home-lawn seed mixtures. It is hardy. Seed is still being harvested from fields that have existed from colonial times.

The addition of a few other selected varieties of bluegrass to a core of the natural is recommended. Some are: Merion, Park, Newport, Delta. Such a blend will take care of varying conditions, the basic reason for seed mixtures.

Bluegrasses do not take well to close mowing, and should be left standing from 1½" to 2½" tall.

Red fescues. An excellent companion for bluegrass, they thrive in shady areas and will fill in on poorer soils. They are not, however, as good sod formers as bluegrass. But their growing habits are the same. Mowing should not be below 1½". Good lawn varieties include Chewings, Pennlawn, Ranier, Illahee, and the Oregon-grown parent stock, Creeping Red.

A combination of Kentucky bluegrasses and red fescues is recommended by both the Department of Agriculture and The

Choosing the lawn grass that grows best in your area

CLIMATE IS THE CHIEF FACTOR in determining what grasses to choose for a lawn. Shown on the map are the recommended types for the various climatic areas of the U. S. Sometimes local conditions, such as the soil quality, an abundance of water in a generally dry section, and the care you are willing to give a lawn, will enable you to use the better grasses in areas where they do not thrive normally. Check with the county agricultural agent, your state agricultural experiment station—or a neighbor who has a flourishing lawn.

KEY TO GRASSES

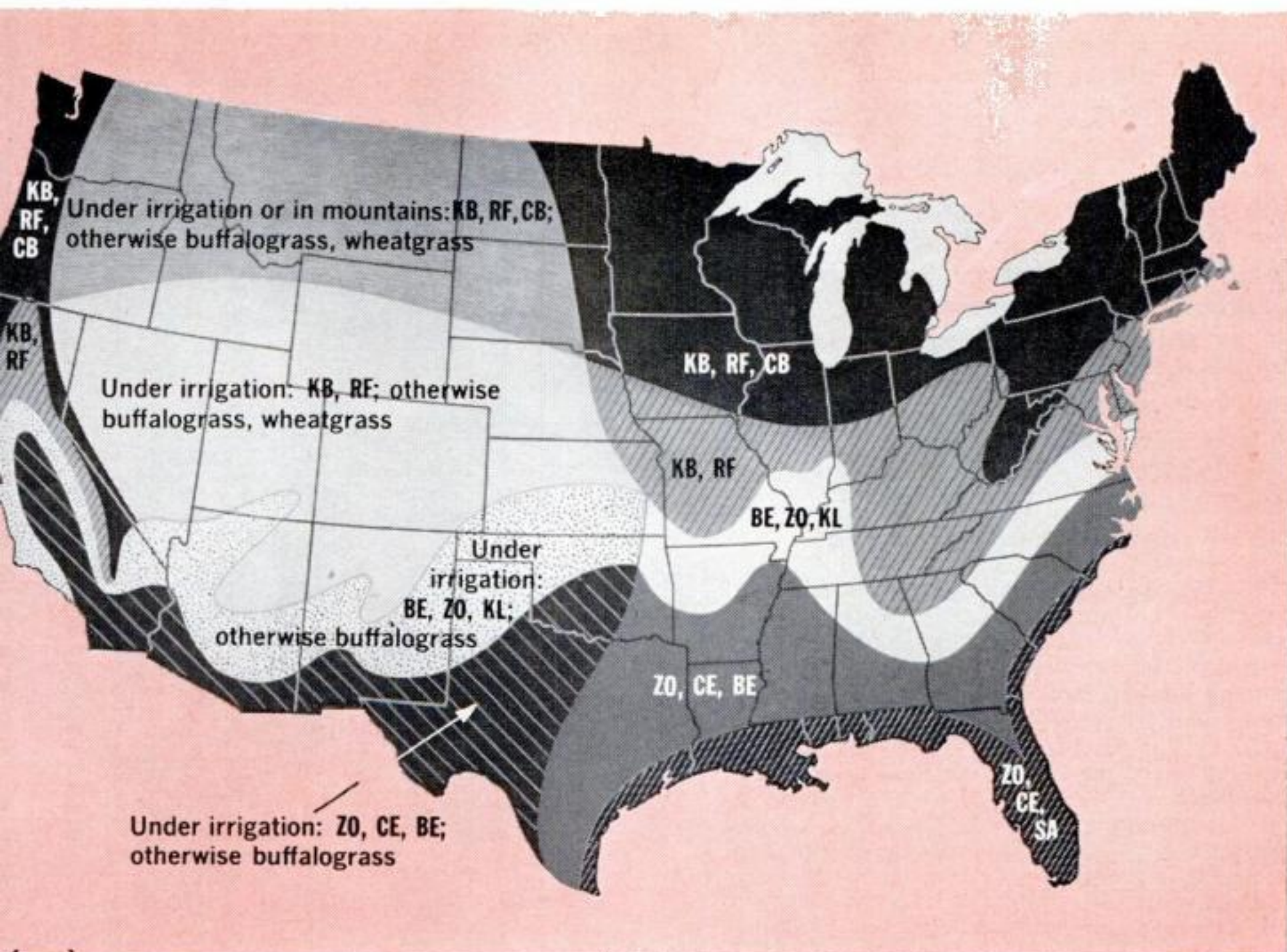
KB . . . Kentucky bluegrass
RF . . . red fescue
CB . . . colonial bentgrass
BE . . . bermudagrass
ZO . . . zoysia
KL . . . Korean lespedeza
CE . . . centipede
SA . . . St. Augustine

Lawn Institute as excellent for the majority of lawns in the cooler, more humid parts of the United States (see map). A good general-purpose mixture is two parts bluegrass to one part red fescue. For shady areas, the proportions should be reversed.

Colonial bentgrass. This fine-textured permanent grass does best in the northeastern section of the country. It needs greater care than the bluegrasses and red fescues: frequent fertilizing, and watering during dry periods. Unless closely cut, about ¾", it tends to become fluffy and form undesirable mats.

Poa trivialis (rough bluegrass). Very tolerant of shade. Like colonial bentgrass, it needs more care than the average homeowner is likely to give. It needs moisture, and is seriously injured by hot, dry weather.

Temporary grasses. Ryegrass, redtop, and meadow fescue (not to be confused with red fescue) are the most common. Because they germinate quickly and produce large seedlings, they are often included in mixtures to serve as nursegrass.



The theory is that they give a fast cover while the slower-growing bluegrasses and red fescues become established. But if there is too much in a mixture, they will compete with the permanent grasses for moisture and food. They should never be more than 10 percent of the total seed content. If a seed mixture has a good permanent-seed base, they are not needed.

Temporary grasses do have their use. On steep banks their quick start helps prevent erosion. Sown in late spring or summer, they'll give a quick temporary lawn to enjoy until you put in a permanent one in the fall, the best time. If a lawn is seeded too late in the spring, weeds are likely to take over before the slower-sprouting permanent grasses are able to get a start.

White clover. Although not a grass, white clover is found in many lawn-seed mixtures. Its use is a matter of personal preference. Some people like the patches of white flowers it produces. Others object to the patchiness and to the bees attracted by the flowers. The patches remain greener than grasses during hot,

dry weather, but they also are slippery. Perhaps the best argument in favor of this plant is its ability to supply nitrogen to the soil. No matter how much you love white clover, its proportion in a mixture shouldn't exceed five percent.

Tall fescue. If you see this listed on a seed mixture, don't confuse it with red fescue. You may also find it listed as Alta fescue or Kentucky 31. It's a pasture grass, and excellent for play areas, athletic fields, and other places where traffic is heavy, but beauty is secondary.

Orchardgrass and timothy. These are bunch grasses that are frequently put into cheap, poor-quality mixtures. They have no use as lawn grass.

Other information on the label

- Germination. Must be listed for each kind of seed, and should average in excess of 80 percent.
- Germination test date. Customarily within six to 12 months. Most state laws require retesting after nine months.
- Inert matter (chaff, sticks, dirt).

For a mixture this should be less than 10 percent.

- Other crop seed. Not more than five percent.

- Weed seeds. Not more than $\frac{1}{2}$ percent.

- Noxious weed seeds. These, if any (some states permit none in a mixture), should be named. Check locally to see if they will be harmful to your lawn.

Your best bet on getting a good mixture (and reliable information) is to buy from a reputable seed house or your local garden center.

Cover plants for deep shade

THERE ARE A NUMBER of good ground-cover plants that will flourish in spots where no lawn grasses will grow—in heavily shaded places, rough and rocky spots, on steep banks, terraces, drainage ditches. And they don't need mowing—but usually require heavy weeding.

- English ivy. Most useful on steep banks and around the base of trees. It develops into a dense mat.

- Pachysandra (Japanese spurge). A low-growing evergreen that spreads by putting out suckers. It is planted by setting out cuttings or plant divisions.

- Myrtle (common periwinkle). A hardy, low-growing evergreen that develops violet-blue flowers. Forms a dense mat, thrives in moist, rich soil. Although dense shade doesn't bother it, myrtle will grow in the sun. It is planted from cuttings.



Ground ivy (photo above) is a weed where not wanted. Here it fills in what otherwise would be an ugly bare spot around the base of a tree. It needs occasional thinning. Flowers in foreground are crocus blooms.

In the South: building lawns from live plants

SEED MIXTURES ARE NOT USED to any great extent in the southern parts of the United States. For many of the grasses that thrive in a hot, humid climate, such as bermudagrass (but not the common), St. Augustine, and zoysia, no seed is available. Either they do not produce enough seed or they do not breed true. These grasses are planted vegetatively from live plants, using sprigs, plugs, or runners, or by sodding.

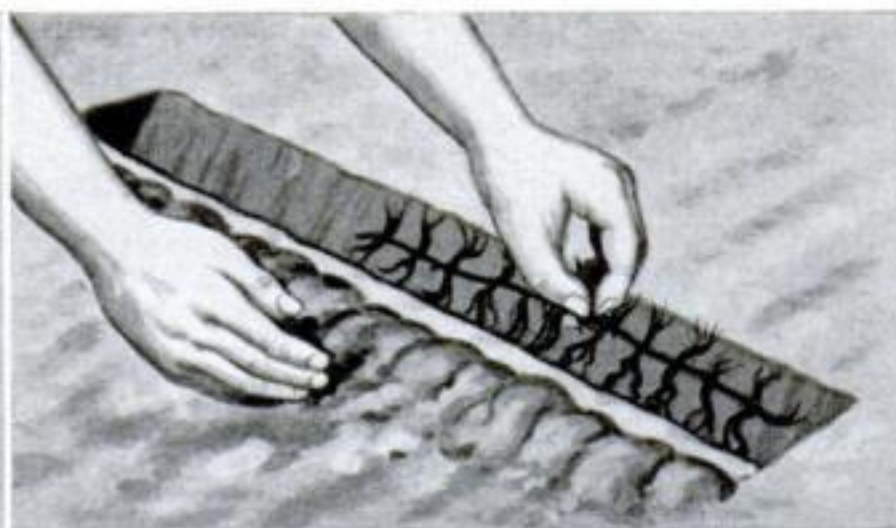
Where seed is available, usually only one

species of grass is sown. This eliminates the problems of ill-designed mixtures found in the North. This also is true for the nonirrigated parts of the Great Plains and the arid Southwest (see map). Southern seeds, of course, must meet certain standards of purity and germination to produce good results. Buying from a reputable seed dealer is your best safeguard.

Northern grasses are sometimes sown for winter cover in Southern lawns.



ZOYSIA can be planted from root runners. These are sold in bags, should be kept in cool water until set out. Single runners are planted in



trenches with the grass blades above ground. Grown in a home-nursery plot, they develop sod that can be transplanted to your lawn.

WASH A GALVANIZED SURFACE with plain soap or detergent and water before painting. This

removes any oil that would prevent good adhesion. Turpentine or mineral spirits work, too.

How to Paint Galvanized Metal

ORDINARY paint won't stick to new galvanized metal for long. If you've painted gutters or garbage cans you know that some preparation of the surface is necessary.

The old tricks of allowing galvanized metal to weather outdoors so the zinc coating will oxidize, or treating the surface with vinegar or other acids to etch it, may not be the sure cures they were once thought to be. That's the latest word from paint experts in a booklet entitled, "Painting Galvanized Steel," just published jointly by the American Iron and Steel Institute, the American Zinc Institute, and the National Paint, Varnish and Lacquer Association.

Watch out for "inhibitors." Weather-

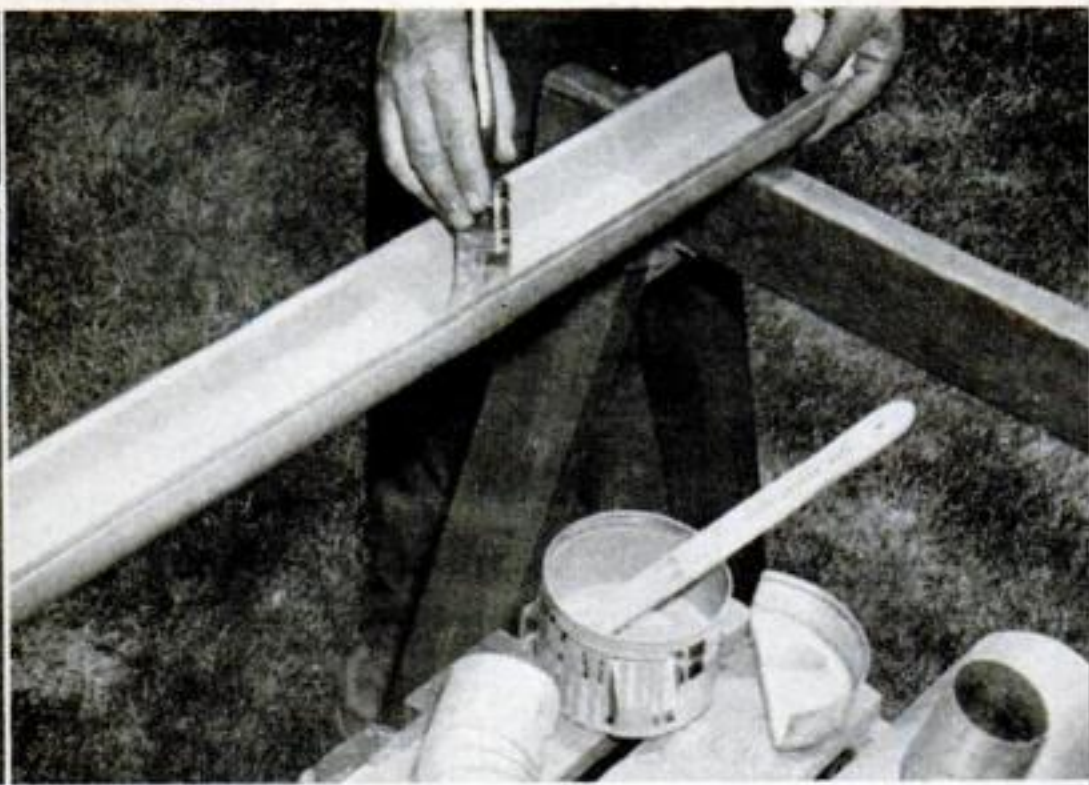
ing is important, say these experts, but not for the reason you may think. Modern galvanized metals are treated at the factory with special inhibitor coatings designed to give temporary protection against staining during shipping and storage. Since some of these coatings may be difficult to paint over, it is desirable, where possible, to leave them exposed outdoors at least six months so they will oxidize before you attempt to cover them. If you must paint sooner, try to find out who the manufacturer is and ask him for instructions that apply to his particular chemical coating.

Prolonged weathering is actually bad because it allows the metal to rust in spots where the zinc coating has been

Where would you use galvanized metal primers? Try these spots



ON GALVANIZED SCREENS to prevent rust; on copper screens to avoid staining on wood frame. Using a scrubber minimizes clogging of mesh.



ON GUTTERS AND DOWNSPOUTS before you install them. You can add a top coat of regular paint later to match the color of your house.

chipped or worn away, such as around nail or screw holes. So-called short-cut methods of etching with acids can also be dangerous; the acids may eat too deeply into the zinc coating and destroy its effectiveness. Such acid washes are hard to remove and may remain to undermine the paint.

Some old-timers still favor red lead as a primer for *any* metal surface. But paint men say it's no better than an ordinary house paint on galvanized.

The only sure preventive for peeling paint, report the experts, is to put on first a primer coat made especially for galvanized metal. This provides a shield to protect the zinc against chemical action. It's the chemical action of the zinc underneath that causes ordinary paint to flake off. Once the special primer is on, you can safely cover it with any ordinary good-quality exterior paint.

Read the label. Primers come in many types, depending on the kind of protection they're designed to give. Some merely precondition the metal and must be followed with one or two coats of regular exterior paint. Others both condition and paint the surface in a single coat, although a second coat is advisable for long life.

One common preparation is called metallic zinc primer. This consists of an oil vehicle with a pigment of approximately 80 percent metallic zinc dust and 20 percent zinc oxide. The contents are stated



ON REFUSE CANS to double their life. You can make them more sightly, too, with just a primer coat. Or add a top coat of house paint.

on the can's label. This kind usually comes in a neutral gray and requires a top coat of regular paint for coloring. Other primers are available in up to half a dozen colors to match the house.

If you must get by on a one-coat job, choose an oil-base portland-cement paint or similar preparation made for the purpose. Your best guarantee of getting the right paint is to be sure the label reads: "For use on galvanized steel."

Before applying a primer, wash a galvanized surface thoroughly with mineral spirits or soap and water to remove any grease or oil. Loosen caked dirt or scale with a wire brush. Allow the surface to dry completely before starting to paint.

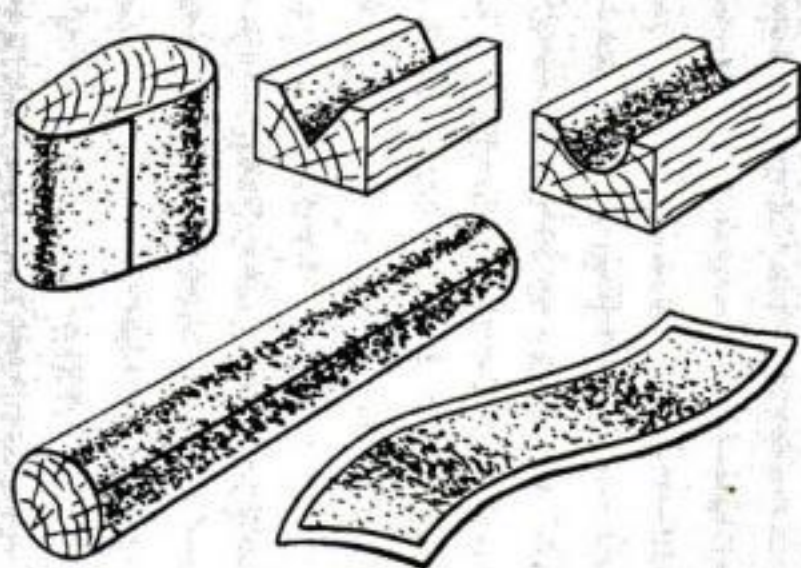


Short Cuts and Tips

FROM PS READERS

Shoe Bin from Hardboard Scrap

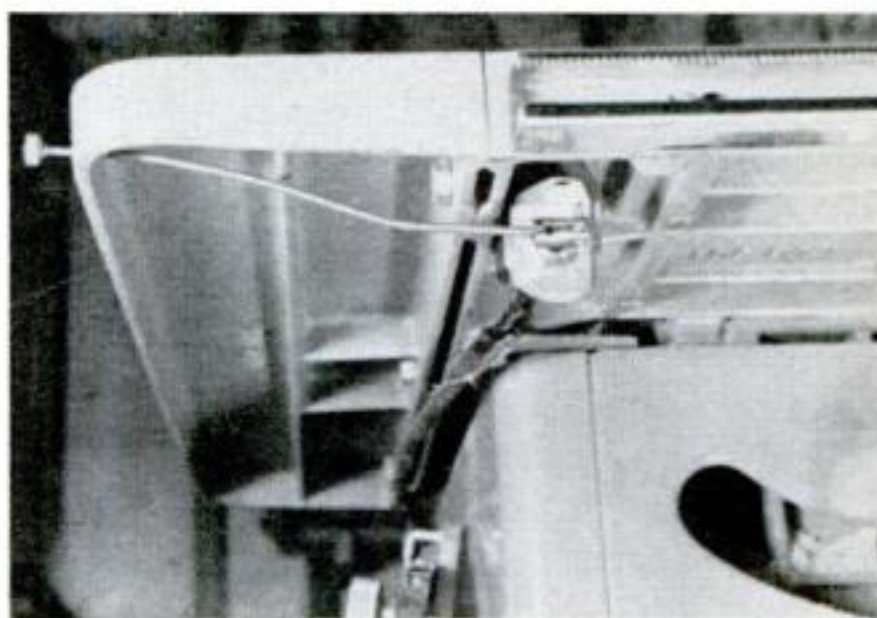
HARDBOARD waste—pieces too small to use on a specific project—can be put to work holding shoes. Trim the scraps into side and bottom pieces big enough to form shoe-size compartments. Cut grooves in scrap one-by-twos to match the thickness of the hardboard. Glue the hardboard into the grooves; nails are used only to hold a back to the cross pieces.—*D. A. Williamson, Glen Ellyn, Ill.*



Sandpaper Sticks for Cabinets

IN MY cabinetwork, I find lots of use for sandpaper sticks. I make them by gluing sandpaper to different sizes and shapes of wood—oval, round, concave, and V-shaped. I also glue sandpaper to strips of cloth and use them as I would a shoeshine cloth for flexible smoothing of contours.—*F. G. Semple, Ottawa, Can.*

▶▶▶ DRILLING the right size clearance hole for a bolt is easy if you let the bolt select the drill. Chuck the bolt into the drill only finger tight so that it can be withdrawn without opening the chuck. Then experiment to find what size drill the chuck will accept, and you're all set: Just use the next larger fractional size drill.—*J. I. Mitchell, Horseheads, N. Y.*



Relocating a Saw Switch

You can move your saw switch if it's now in an inconvenient spot. Mount it on a table-extension bolt, using a bracket bent from 16-gauge steel and drilled to accept both the switch and the mounting bolt. A control rod can be made by threading both ends of a short piece of $\frac{1}{8}$ " welding rod. Attach one end of the rod to the switch with a clevis made from a piece of $\frac{3}{8}$ " rod. Lead the other end through a hole in the table edge, and screw on a knob. With a double-ended clevis and a second rod leading to the opposite side of the table, you can turn the saw off from either side. If both hands are busy, you can even turn off the relocated switch by nudging it with your knee.—*W. H. deFontaine, Glenbrook, Conn.*



Secrets of Making and Flying Chinese Kites

Since the early beginnings of civilization, kite flying has been a serious art to Asiatic peoples. Weird and colorful shapes representing birds, beasts, and dragons, originally part of mysterious religious ceremonies, are still used in some regions to frighten away evil spirits. In China, the practice is celebrated as

national Kites' Day on the ninth day of the ninth month. People of all ages leave their work at this time and fly elaborately artistic kites. To learn their secrets, POPULAR SCIENCE sent Bob Gilmore into the heart of San Francisco's Chinatown. What he found is told in the accompanying article.

By Bob Gilmore

I AM 44 years old. My feet are flat and there's something sprung in my sacral region. But you should see me galloping up and down the field outside my house.

What gets me out there? Lots of old codgers like me have the first reason—which is boys who want to fly kites. The second reason is a very special kind of kite that's impossible to resist whether you're a small boy or a grown-up boy.

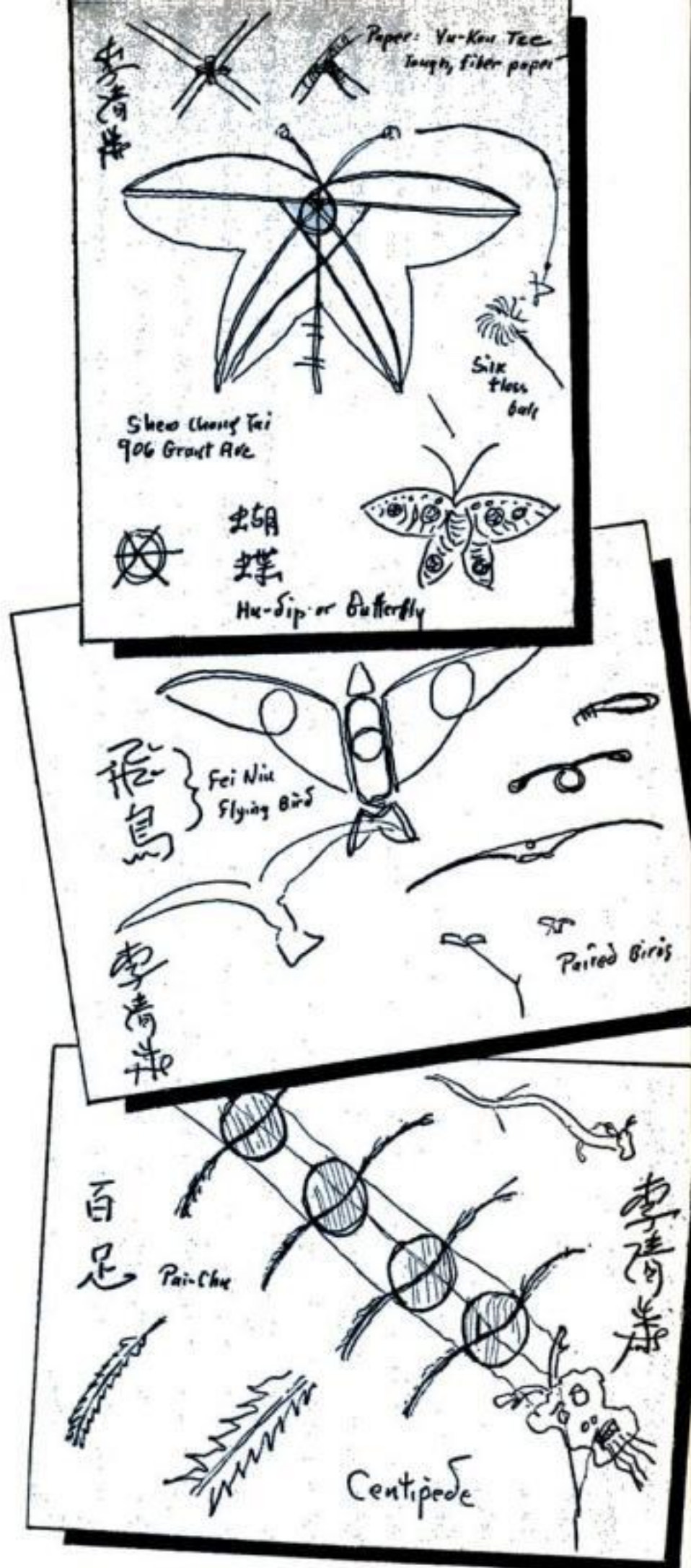
It takes out string as if it had a home-ward-bound angel hooked to it. It beats every boyhood kite you ever saw for beauty and novelty. And it calls for some pleasant hours of boy-dad building instead of a quick trip to the store for a factory-made job.

Four types. Thanks to my good Chinese friends, I learned how to make four varieties of Chinese kites.

In San Francisco's Chinatown, I got the construction details from actor-historian-lecturer Lee Chingwah. The *Pai Chu* is the dragon shape (call him "centipede" lest you offend the dragon); *Fei Niu*, the flying bird; *Hu Dip*, the butterfly; and *Gin Yiu*, the fighting kite.

All but the fighting kite are wonderfully intricate concoctions of bamboo, paper, and string. The fighter is the familiar plain diamond shape similar to

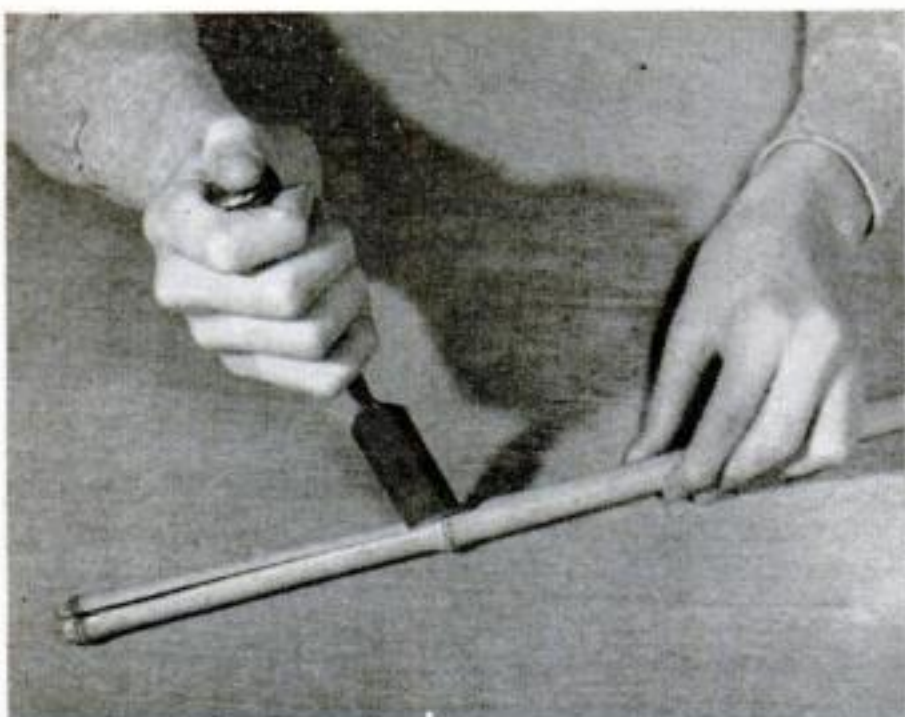
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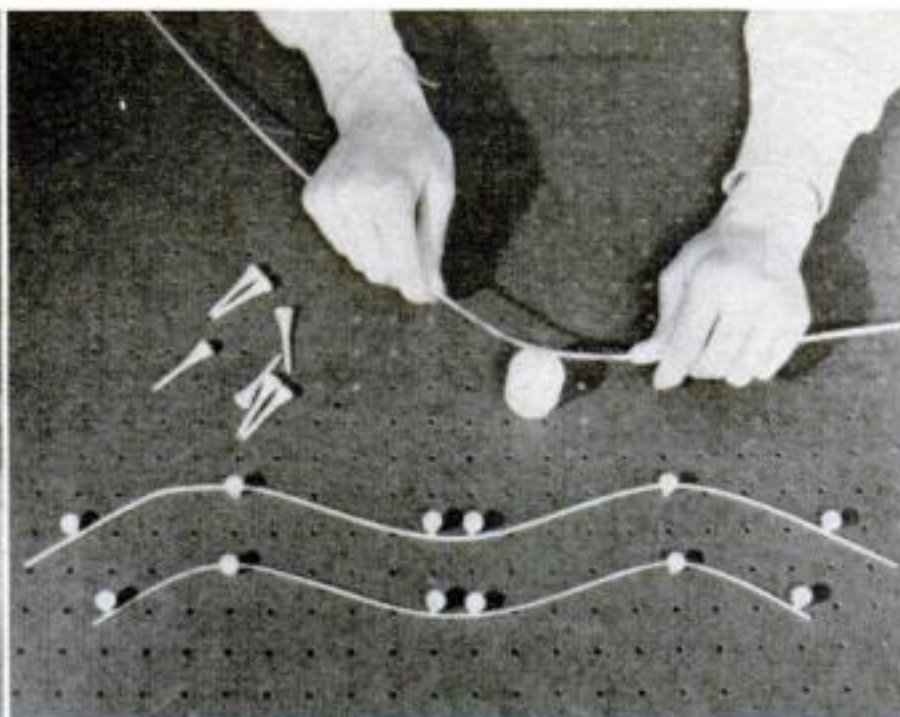
ORIGINAL SKETCHES of three Chinese kites are shown exactly as they were drawn for **POPULAR SCIENCE** by Chinese author-actor Lee Chingwah. Mr. Lee is an authority on Oriental lore.



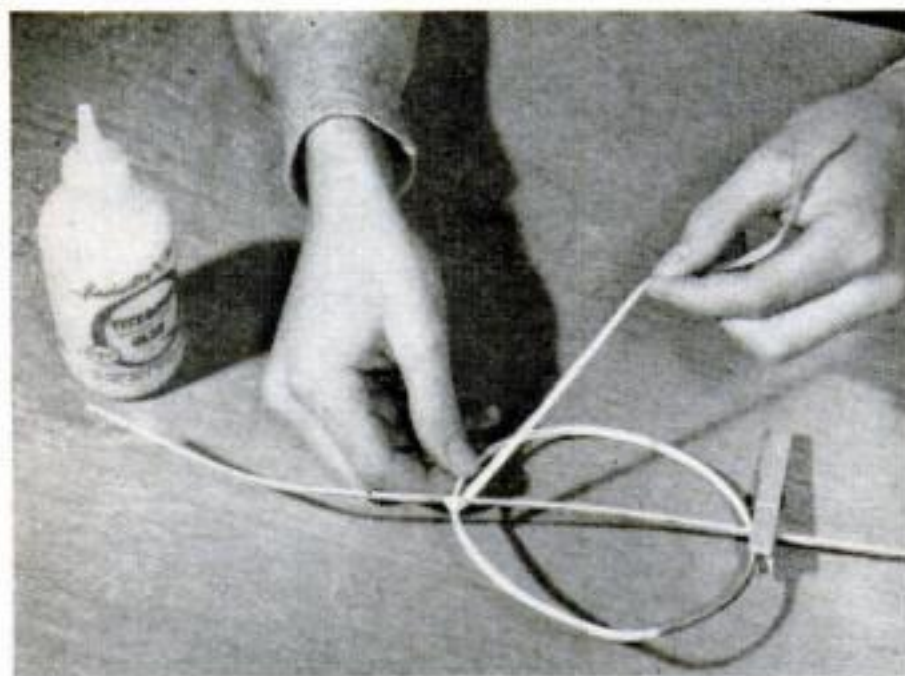
How bamboo is cut and bent to form the intricate shapes



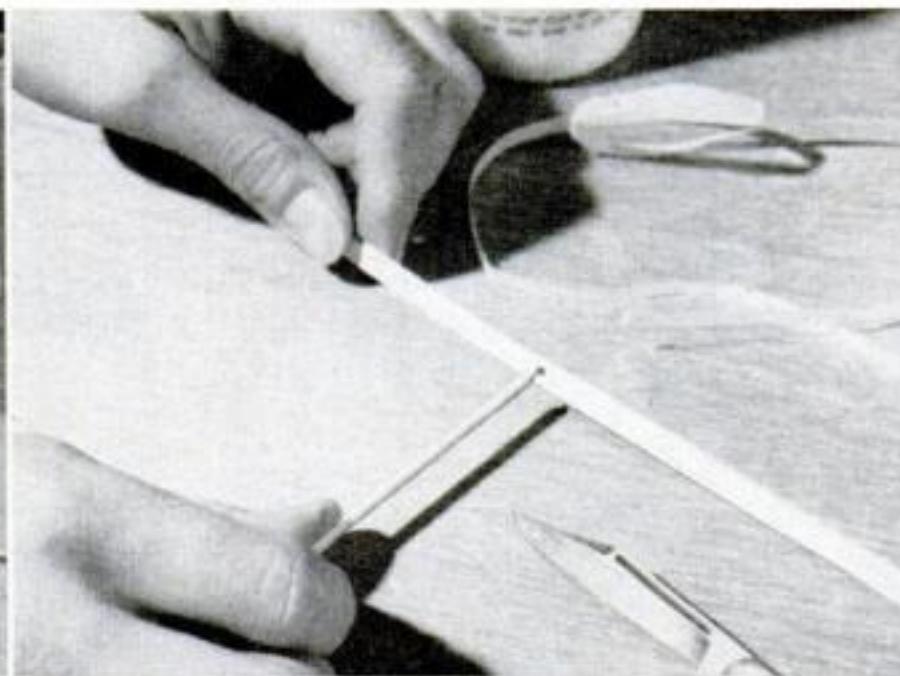
KITES' FRAMES are made from bamboo split into strips. Usually it splits straight except (occasionally) at the nodes. Force a chisel into each node and tap it to insure a clean break.



BAMBOO CAN BE BENT into permanent shapes by heating it, then holding it in position until it cools. Golf tees stuck in perforated board make a simple jig for forming the strips.



JOINTS ARE LASHED TOGETHER with narrow strips of same paper used to cover the kite. Coat the strips with glue. Use a spiral wrap to join ends, a crisscross lash where members cross.



AN OLD CHINESE TRICK: Extra strength is gained at a T joint by boring a hole in one piece and whittling a point on the other one to fit into it. Wrap joint with crisscrossed paper.



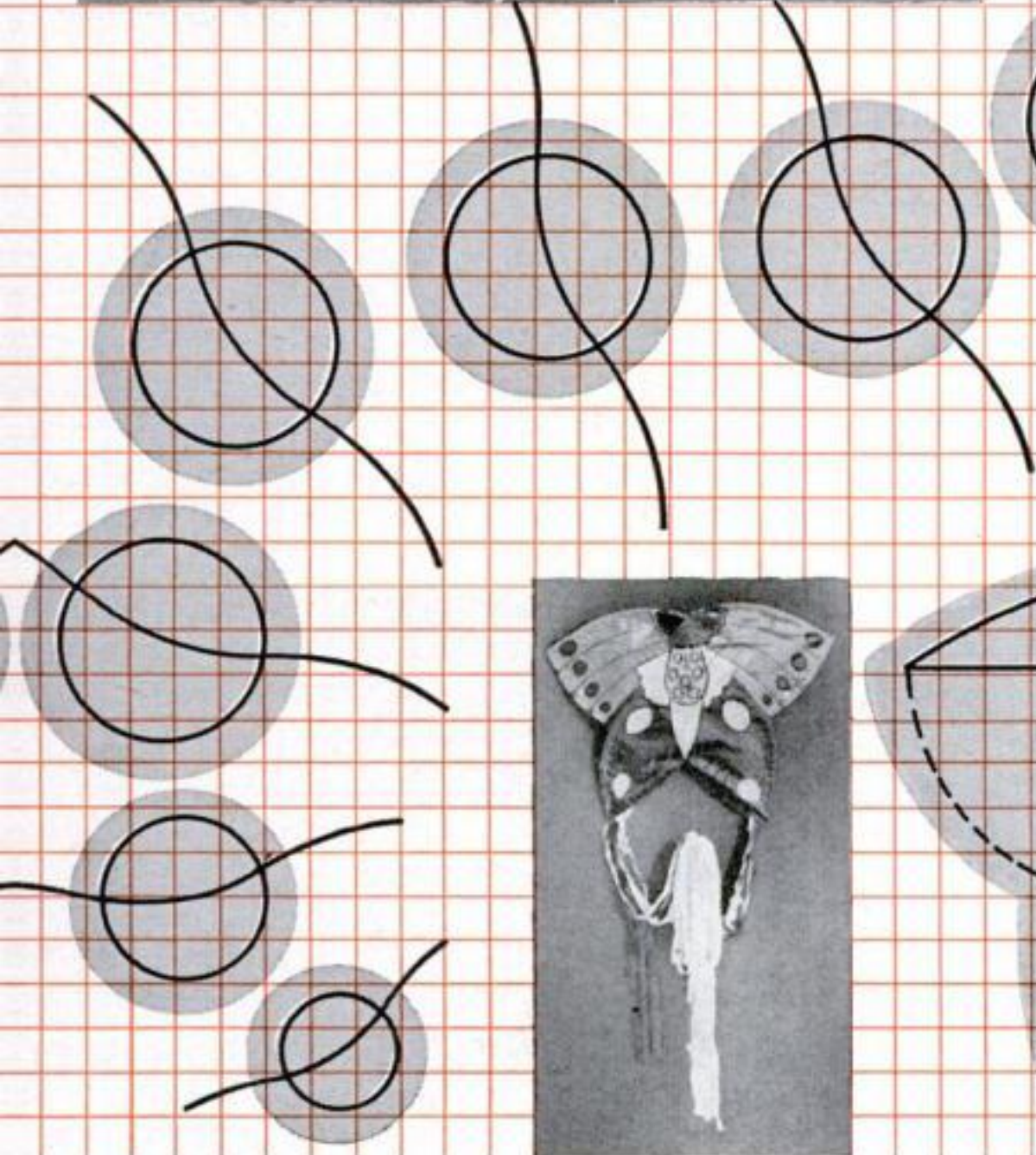
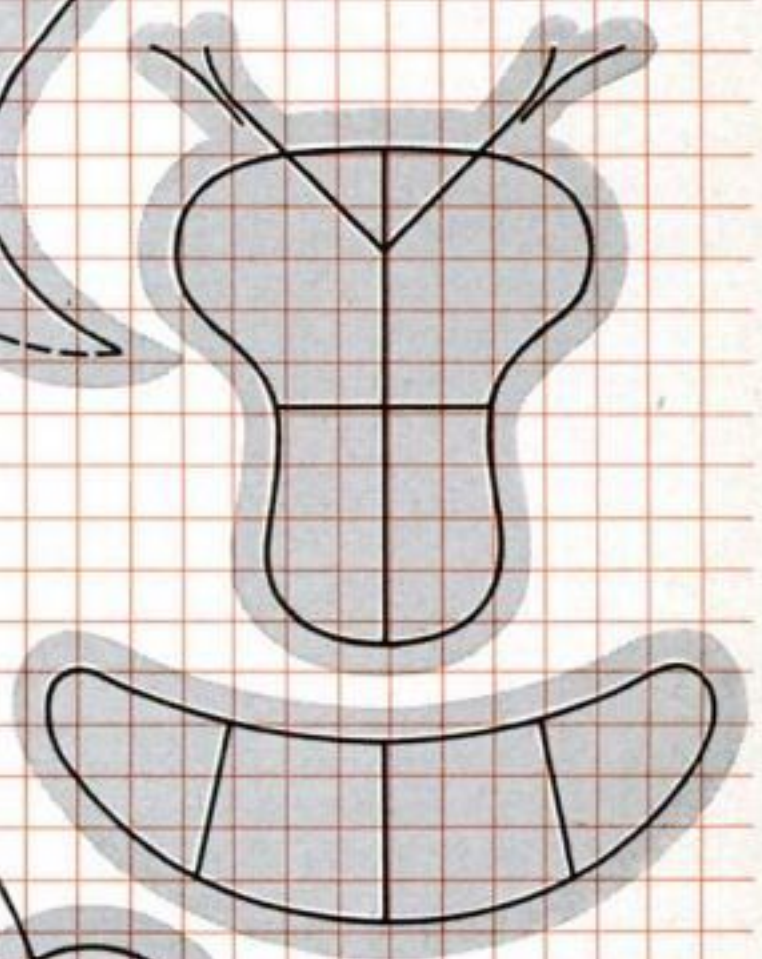
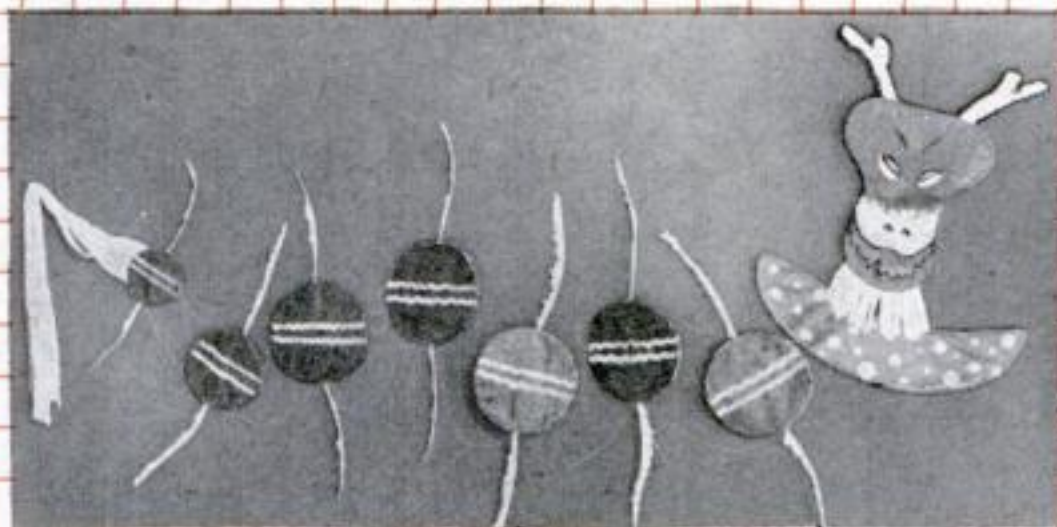
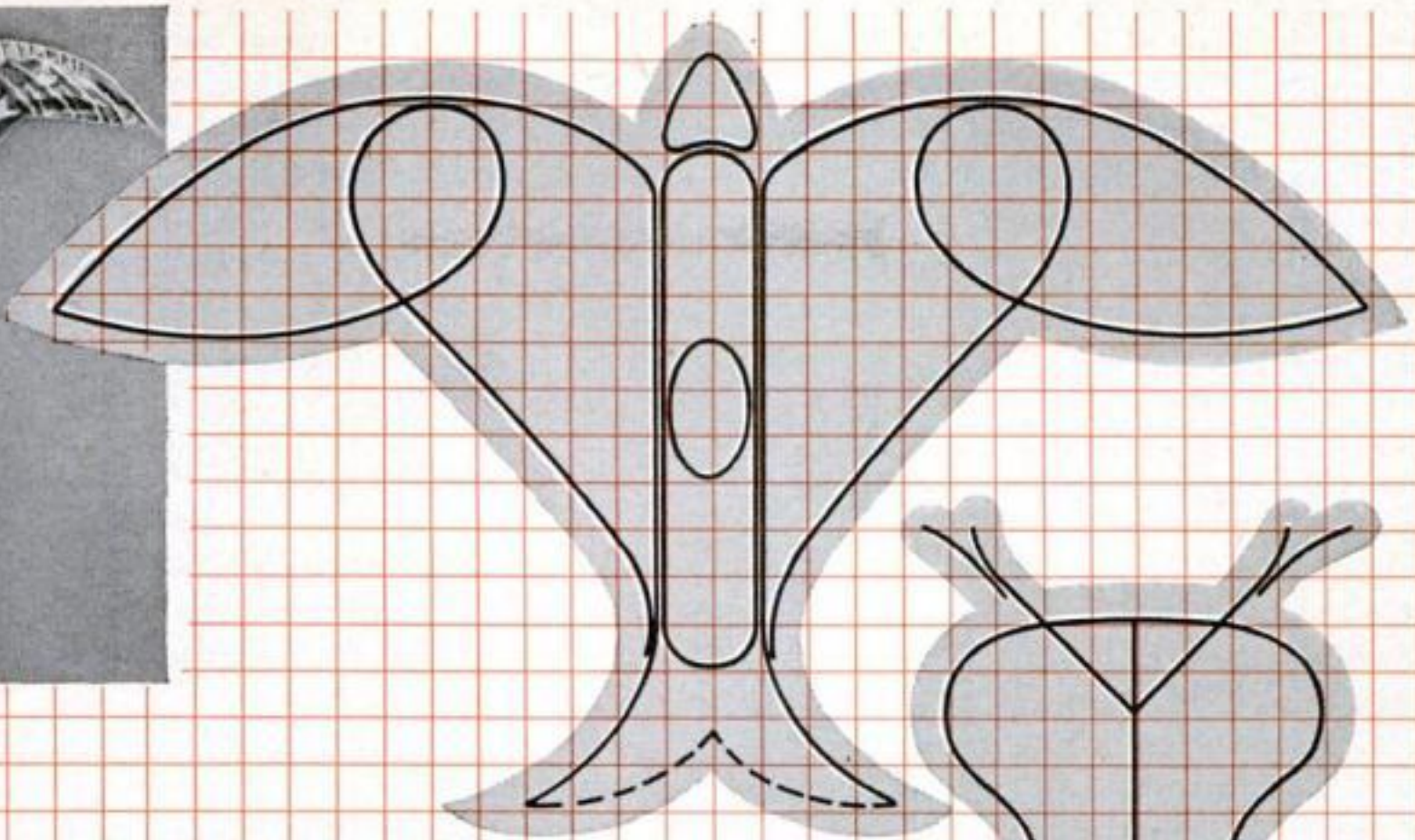
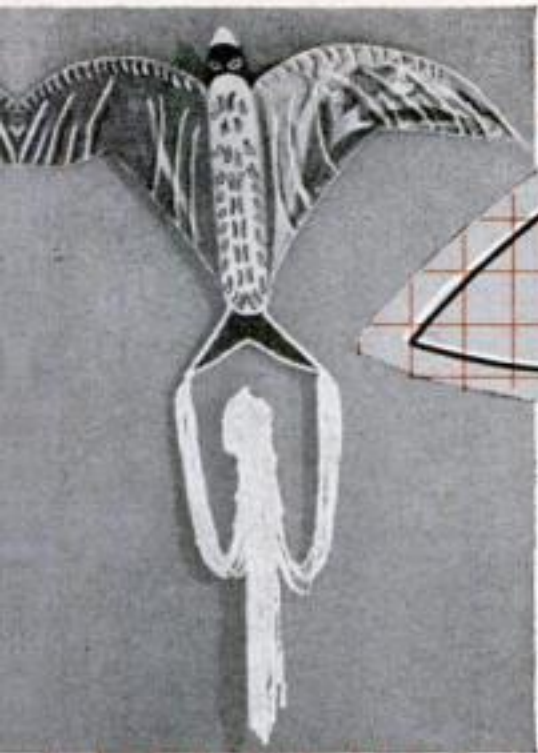
TO COVER KITE, cut paper slightly larger than frame. Slit edges along curves and glue them around the bamboo struts. Use thread to reinforce edges where there's no supporting strut.

our American dime-store version, except that it's rigged with deadly blades for the jolly sport of severing the lines of opponents' kites.

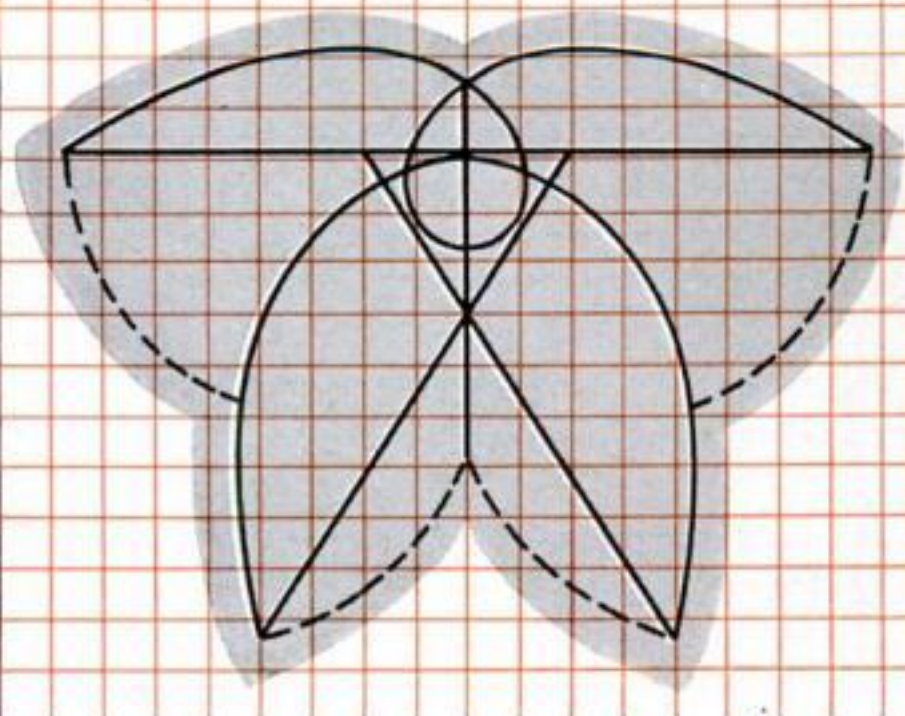
In building the frameworks, we followed Mr. Lee's sketches carefully. But he left the decoration to me and my boys, since that is, after all, part of what makes this *your* kite, be you Chinese or Cherokee.

Framing. Following tradition, we used split bamboo for the main members of the frames. Rattan, even lighter and more flexible, made the lesser members.

The Chinese cover their kites with a tough and fibrous paper called *Sar Tze*. But you don't walk in and buy such a paper just anywhere. So we broke tra-



2" SQUARES



CONTINUED

dition by using Patapar 27-2T, a high-wet-strength and oil-resistant parchment.

Gluing. The same paper, cut into strips and coated with glue, lashed the framework together. We used both a new aliphatic-resin glue and a good polyvinyl-resin type here. The same glues cemented the paper coverings.

Where thread was needed, we used common cotton button thread. For flight string we bought (from a local surplus store) a 1,000-yard spool of thin cotton line so strong that I burned my fingers trying to break it.

Decorating. All of the kites are elaborately figured except for the fighter, which, being expendable, got only a quick one-color spray job.

Water-base colors, we found, wrinkle and stretch the paper too much. Aircraft dope would wrack the frames with its drastic shrinking action. So we used model-car enamel in small jars that cost only a few cents and can be bought anywhere. Even these gave us some stretch.

Some spots on the kites, and all of the fighters, were sprayed with pressurized pushbutton high-visibility orange, which glows like fire in the sky. Other colors

used were red, blue, yellow, and black.

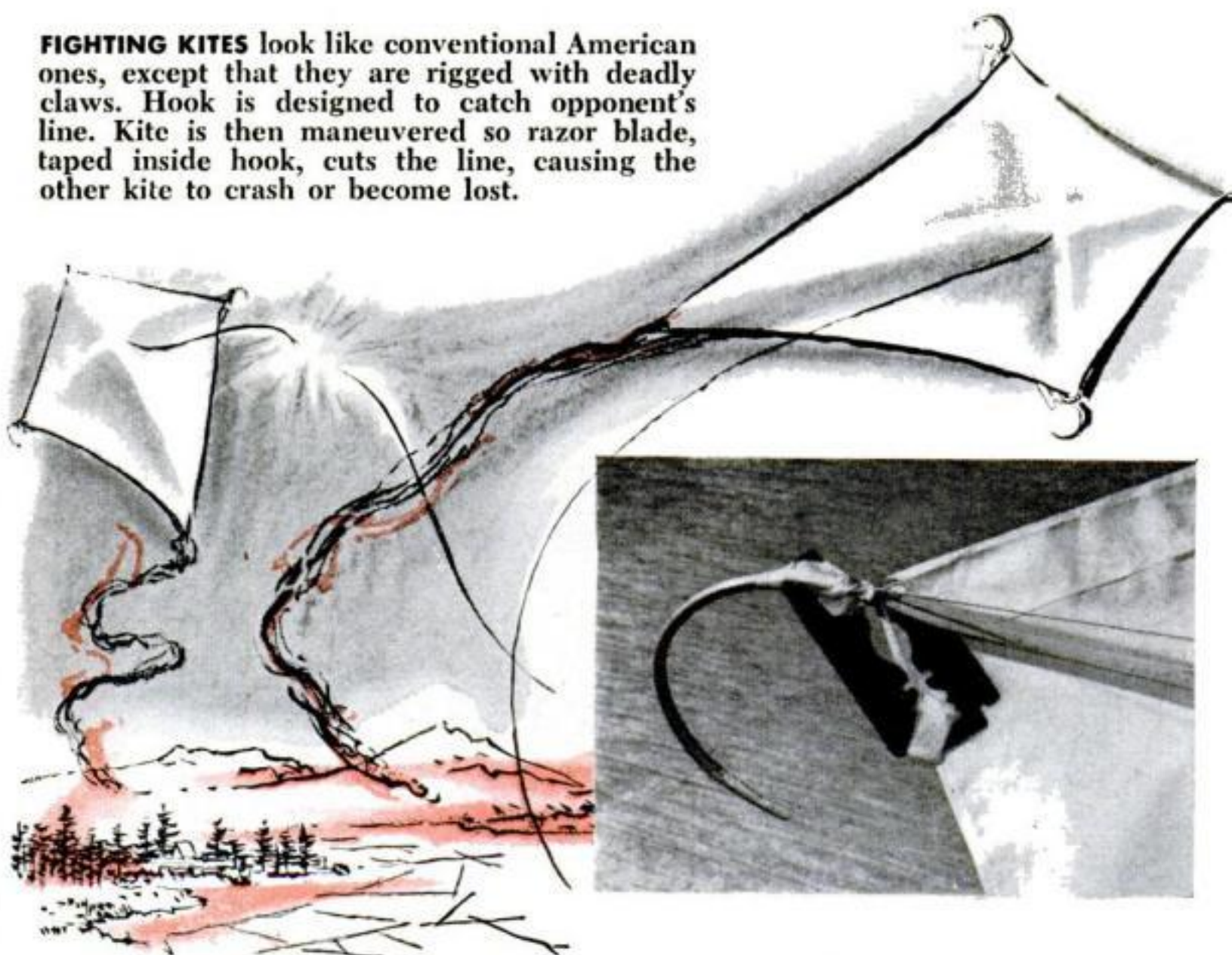
Flight-testing. From our friends George and Dan Yeh, only two years out of China, we learned a neat trick for flight-testing a new kite indoors.

Rig the bridle string where it seems to go best by eye and feel. Then lay the kite face up on the floor, grip the flight string at about waist level, and give a swift but smooth pull upward. If the kite comes off the floor without a side-slip and takes an up-slanted flight position as it goes overhead, it's ready for outdoor testing and the final string adjustment and tail-adding that will balance it perfectly.

The bird and butterfly flew best with three-point bridles formed by tying lines to the tail and midpoint of each wing. The dragon uses a two-point bridle fastened at forehead and chin, but requires additional lines from the middle and tail segments that form his lower body.

Another trick we learned from the Chinese is to make the tail streamers out of narrow strips of crepe paper. Being very light, the streamers can be made long for good balance without adding a lot of extra weight.

FIGHTING KITES look like conventional American ones, except that they are rigged with deadly claws. Hook is designed to catch opponent's line. Kite is then maneuvered so razor blade, taped inside hook, cuts the line, causing the other kite to crash or become lost.



李青林

御祝



Short Cuts and Tips

FROM PS READERS

Driving Screws in a Tight Corner

I THOUGHT the carpenter had a screw loose when I saw him back up to the wall with his screwdriver behind him. Actually, he just wanted to use the screwdriver with his right hand in the tight corner. I tried it, and it really helps! You can put all your weight on the driver without strain.—*Bernard Rimland, San Diego, Cal.*

Hollywood Short Cut

HOLLYWOOD likes short cuts, too. This captain's chair with a built-on magazine and newspaper hamper is part of a Los Angeles County Museum display of a modern movie set. For household use—and easy removal—the portfolio-size leather bag could be attached with snaps.—*Glen F. Stillwell, Manhattan Beach, Cal.*

▶▶▶ WHEN you paint porous siding—like redwood—with a wood sealer, try using a sponge instead of a brush. Hold the sponge with a rubber glove, or add a handle by screwing the sponge to a block of wood. Use a large cellulose sponge with small pores, and a bread pan or roller tray to hold the paint. The sponge is especially good for applying prime coats.—*John J. Barr, Ithaca, N. Y.*

Self-Watering Plants

HOUSE plants will water themselves while you're on vacation if you leave them a bucket of water. Put the plants as close as possible to the bucket, and string heavy yarn from the bottom of the bucket to the bottom of the soil inside each plant pot.—*Hans F. Kutschbach, Hannover-Westfeld, W. Germany.*



Built-In Soldering-Iron Rest

HANG your soldering iron on the edge of the bench instead of searching for a place to set it. Drive a nail into the handle, cut off the head, and file the projecting end to a sharp point. Bent slightly outward, the sharp nail will support the iron safely on the edge of the workbench.—*G. E. Hendrickson, Argyle, Wis.*





How to Make Electronic Music

***All you need is
a tape recorder and
a lively imagination***

By Clement Brown

YOU don't have to know one musical note from another to create original "music." It can be startling in its emotional and dramatic impact. You've probably heard this kind of electronic music as mood-building background in TV and radio dramas. Usually it is manufactured by engineers through manipulation of more familiar sounds.

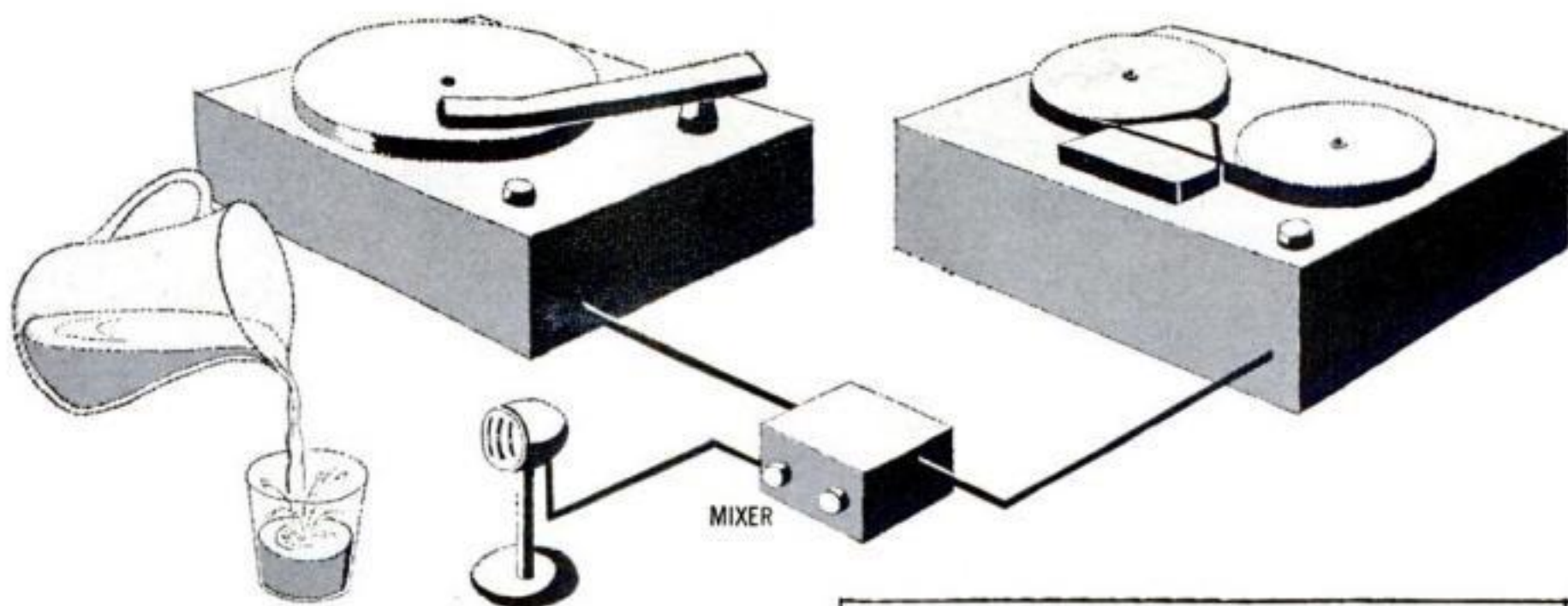
Here is a whole new realm of fun with your tape recorder. With a little technical know-how, a lively imagination, and some taste in arrangement, you can construct musical entertainment to suit any mood.

Fragments of sounds derived from a wide variety of sources will be the raw materials. Once you begin experimenting, you'll be surprised how many ordinary sounds have a basic musical character. You can also allow some human sounds and conventional musical instruments to enter—with appropriate modification. But whatever sources you choose, the final result is made uniquely your own through carefully considered manipulation.

Here are some techniques:

- Variation in tape speed and hence in pitch.
- Reversing playbacks.
- Use of endless-tape loops.
- Artificial reverberation and echo effects.

A COIN SPINNING on a sheet of glass can provide a wide variety of effects, depending on how you record and modify the sound. It can be a quiet, rhythmic background sound—or thunderous timpani. Using an endless-tape loop of the recording, it can go on and on.



LIVE SOUND can be mixed with bits and pieces excerpted from records. A simple mixer you can buy or make is needed to combine the two signals before they reach the recorder input. For variety, try spinning the turntable by hand or running it at other than the correct speed.

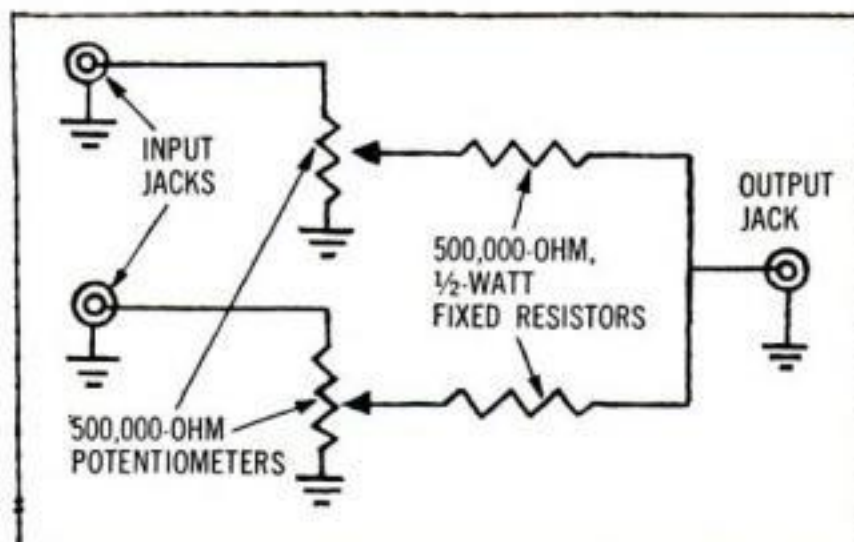
- Superposition of sound sequences.
- Suppression or exaggeration of certain frequencies by means of filters or tone controls.

- Substitution of contact pickup instead of the usual recording microphone.

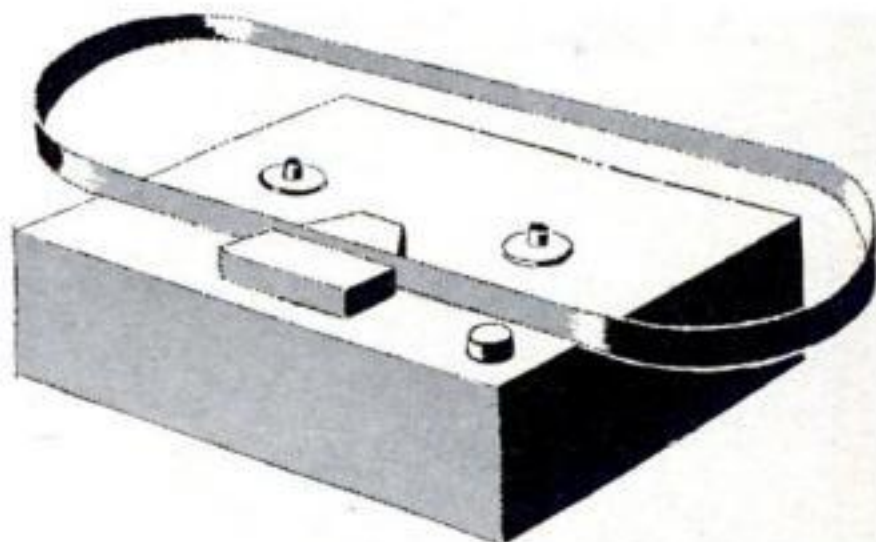
Each effect is recorded separately using only one track on the tape. Later you'll put these fragments together on one master tape. This step makes the difference between a hodgepodge of weird sounds and an imaginative composition.

Variation in tape speed is the most obvious element in electronic music. Experiment by recording at one speed and playing back at another. Try any metal object that gives a ringing sound when struck. Record at high speed and play back at a slower one. The dramatic intensity of these slow vibrations will surprise you. You are not limited to the speeds on the machine. For short takes, suitable perhaps for a loop, you can pull the tape by hand. A mysterious effect can be made by pulling the tape in rhythmic surges while recording a continuous sound such as running water.

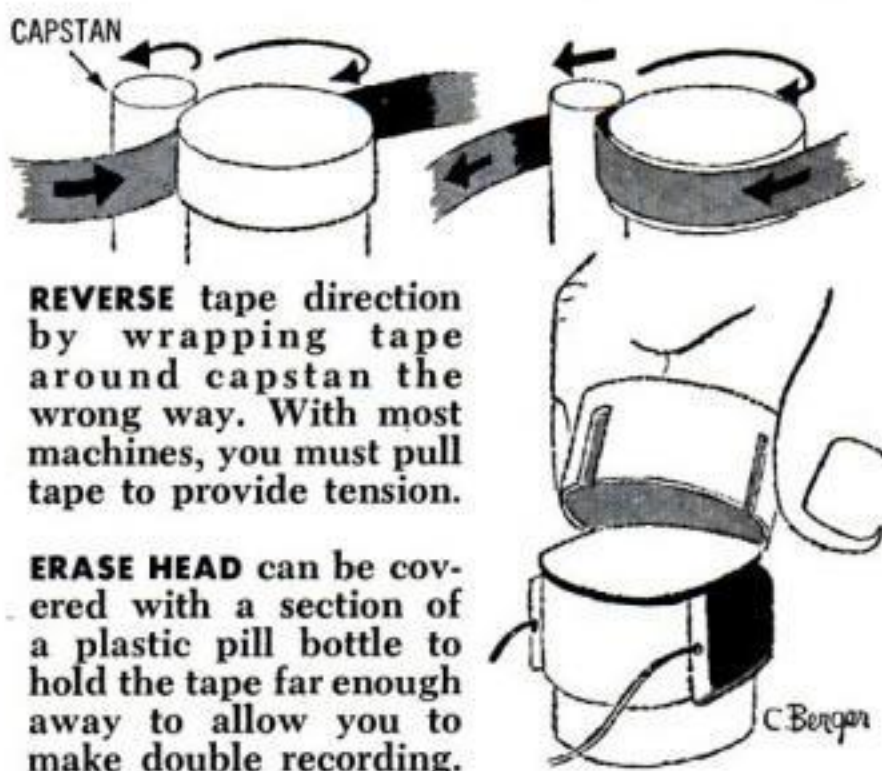
Reverse playback. This is particularly effective for sounds made by striking or plucking. The result is a slow buildup of sound, a spectacular climax, and an abrupt cutoff. It is easy to do with a single-track recorder—simply snip out the section of recorded tape and splice it in again in reverse. It's a bit of a problem with most dual-track machines. One way



HOMEMADE MIXER can be quickly put together from standard radio parts housed in a tin box.



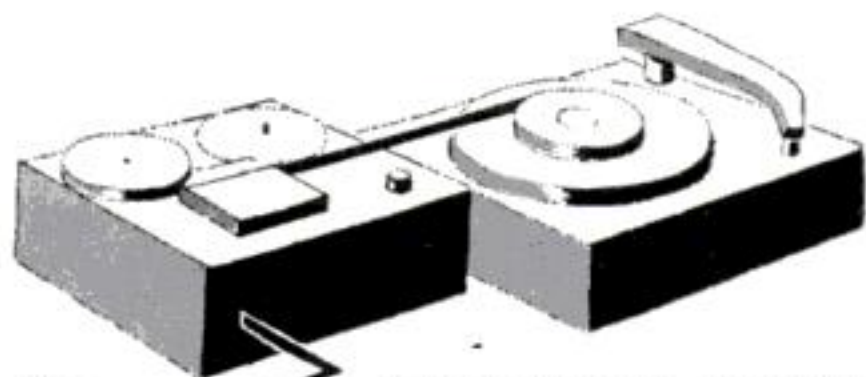
ENDLESS-TAPE LOOP of a recorded sound fragment gives a persistent background rhythm.



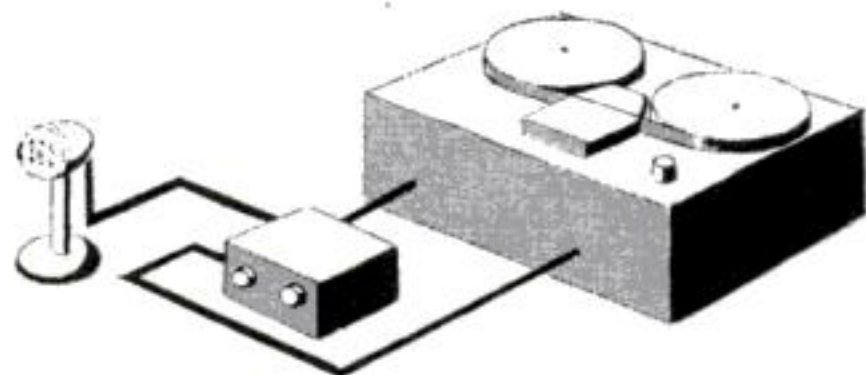
REVERSE tape direction by wrapping tape around capstan the wrong way. With most machines, you must pull tape to provide tension.

ERASE HEAD can be covered with a section of a plastic pill bottle to hold the tape far enough away to allow you to make double recording.

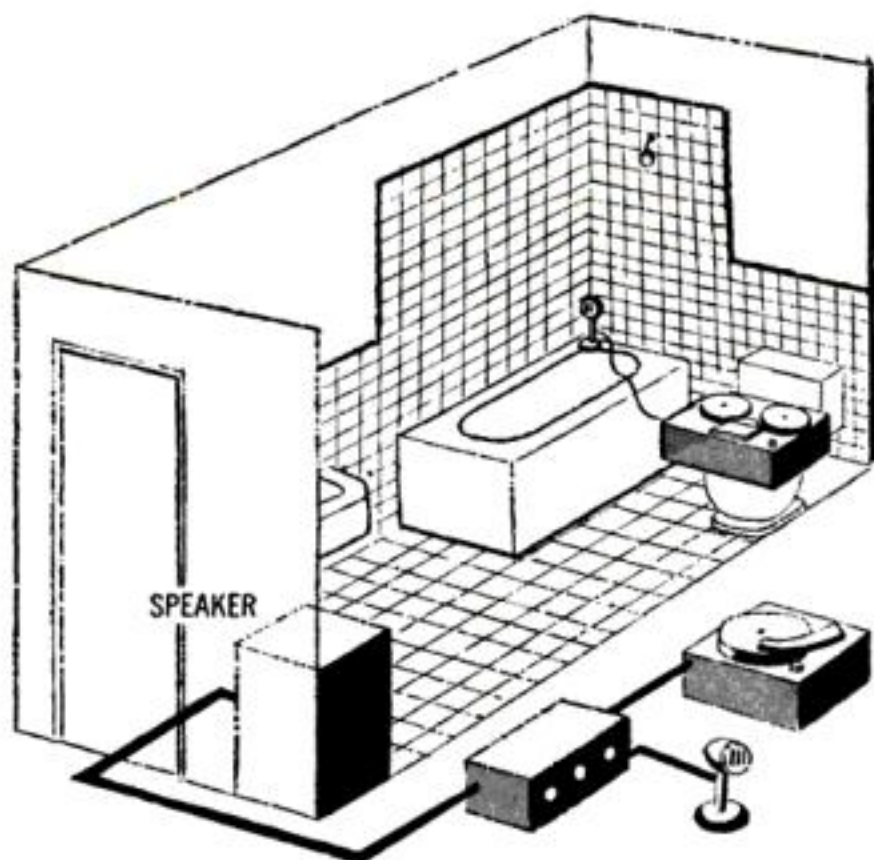
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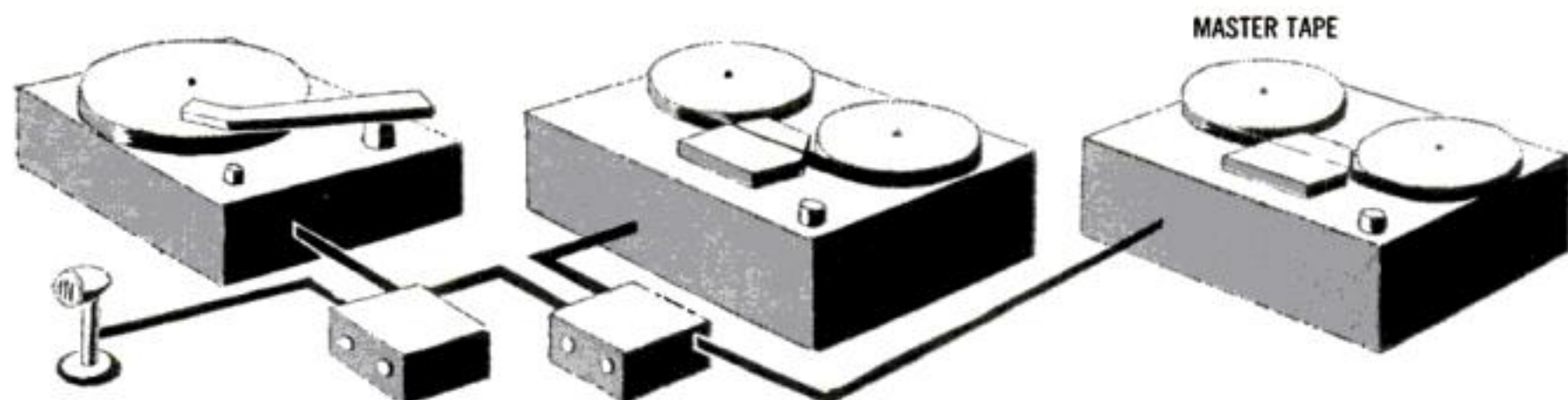
VARIABLE-SPEED turntable can give odd speeds. Fix take-up spool to turntable spindle. You may need to remove the pressure roller on the recorder.



REVERBERATION can be added electronically if there's a separate playback head. Mix a portion of the output with the incoming signal.



ECHO OR REVERBERATION effects can also be made by recording the sound from a loudspeaker in a room with hard-surface walls, as above.



MASTER TAPE is made using a second tape recorder. Taped sound fragments are played on

is to use the scheme shown on the preceding page. This reverses the direction of the tape past the capstan, but you'll have to supply enough tension on the tape to keep it moving past the recording head. How to avoid erasure is described later.

For that offbeat rhythm. A tape loop is another "must." Try it this way. Record the sound of a coin spinning on a hard surface. Cut out this section of tape and join the ends to form a loop. Play back the loop as you would an ordinary tape. The sheer persistence of this strange, offbeat rhythm as the coin slows and finally falls over, then starts all over again, has a special fascination. When you've tried it, you'll think of countless other possibilities with loops.

Artificial reverberation or echo effects can be achieved directly on machines with separate record and playback heads. Simply feed a portion of the output from the playback head back into the input. If your machine doesn't permit this, you can devise an echo room as at left.

Mixers and filters. Recording only one sound at a time limits the scope of your experiments. Inexpensive mixers are available, or you can make your own following the schematic diagram. These let you record from two sources on one tape.

You will also want to add sounds to a tape that has already been recorded—perhaps to arrange for two electronic tunes to run along together. As you know, when you make a new recording ordinarily, the previous recording is automatically erased. Some machines have a facility for avoiding this automatic process. If yours doesn't, you can still achieve the same results. Cover the face of the erase head to hold the tape far enough away for the erase field to be ineffective. A piece of plastic (see sketch) works well.

[Continued on page 238]

one and recorded in proper order on other. New sounds can be added from mike or phono.

Lighthouse Lamp

is a lathe and modeling job

THIS lighthouse lamp gives you a chance to put several different skills to work. The main column is a good example of spindle turning to a constant taper, while the disks are faceplate turnings. The rock-strewn base lets you try your hand at realistic modeling.

The central column is made from a 3" turning square and is given a straight taper from 2½" to 1½". When turning the disks, finish the edges slowly and with sharp tools to minimize the grain distortion that so often occurs in faceplate turning. The choice of wood is important here—the harder the better.

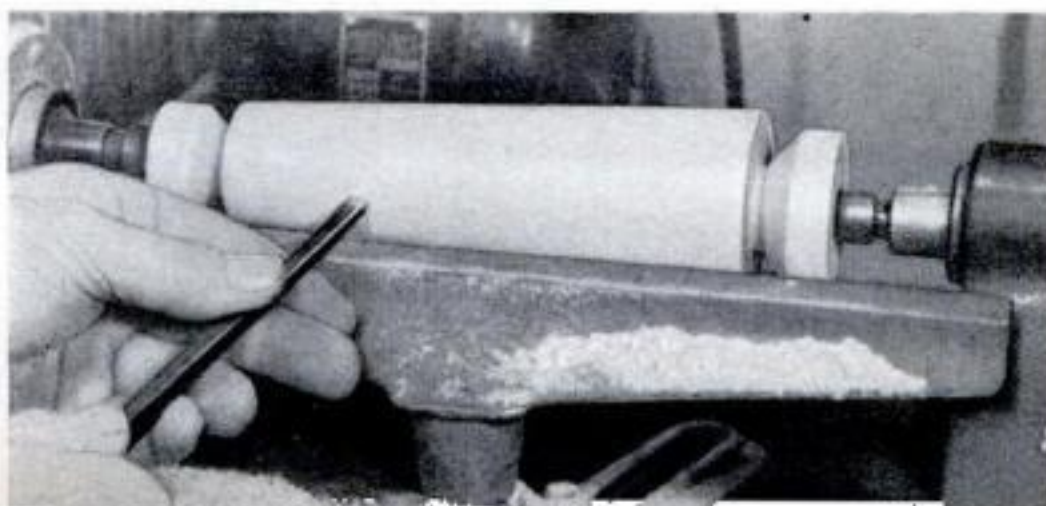
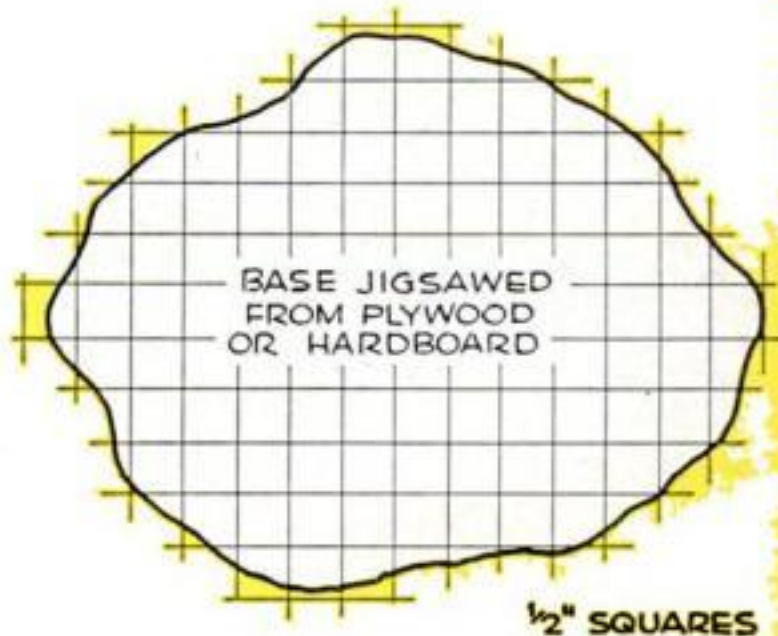
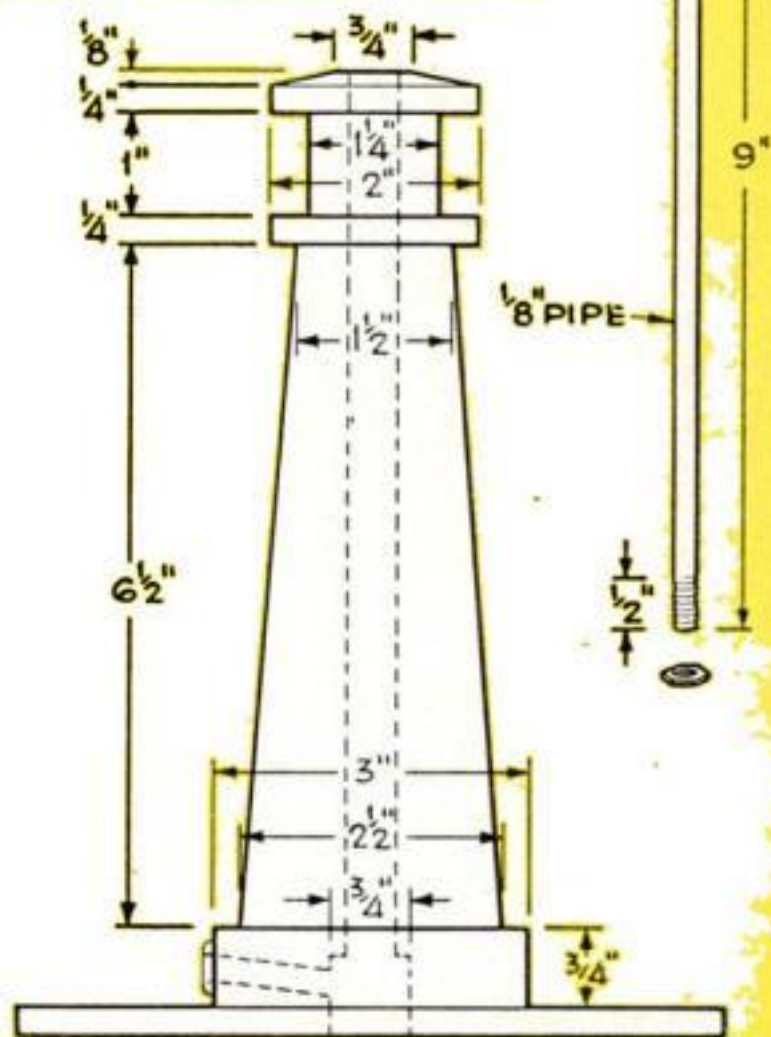
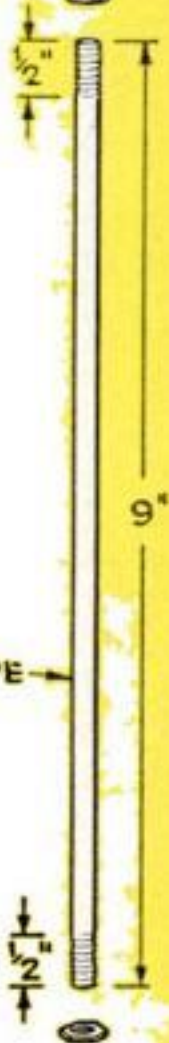
All parts should be carefully faced off square to be sure they will stack neatly together. Each one is drilled with a 7/16" center hole for a length of ⅛" brass lamp pipe that runs up through the assembly. You can accurately locate the center holes if you mark them while the pieces are in the lathe.

The lower disk is drilled or routed out to form a ½"-deep recess in the bottom. Run the lamp cord through a side hole drilled into the recess.

Painting is a lot easier if you do it before the parts are assembled. The lamp shown is finished in alternating bands of white and medium-gray enamel. You'll save work by giving the parts a coat of shellac first to keep the enamel from soaking in too much.

The base can be jigsawed from thin plywood or hardboard. Find some soft stones of contrasting colors and textures, and hammer them into small fragments. A ring of these cemented around the base will simulate the lighthouse's rocky foundation. Paint the outer area beyond the rocks in blue and white ripples to give the effect of water. The underside of the base can be padded with thin felt.

String the parts on the pipe and screw a brass lamp socket on top and a retaining nut on the bottom. You're now ready to go shopping for a shade to top it off.—*Herbert Y. Moon.*



DEAD TRUE, this uniform taper for the lighthouse tower takes a sharp eye and steady hand. Ends are faced off square before spindle is moved from lathe, then excess is cut off.

**Bash a hole in the bottom? Spring a leak at sea?
Here are simple tricks for—**

Bringing a Damaged Boat Safely Home

By George Daniels

A SHINY new cruiser recently struck a submerged stump, coasted into deep water, and sank with a six-inch hole in her bottom. When her owner paid the whopping bill for raising the boat and restoring ruined equipment, the smallest item on it was for repair of the original six-inch hole.

Marine repairmen report that more than 80 percent of the small boats damaged at sea could have been patched on the spot and brought safely to shore if their skippers had used a few basic tools and tricks for emergency repair.

For a quick fix. You don't need as much as you may think. The emergency kit shown below contains a few odd but simple items that will let you make an underwater hull patch. All of the items can be carried in a square foot of space.

The first thing you need is at least one waterproof seat cushion. This serves as a plug to jam against a sudden break in the hull. A 10"-by-14" piece of $\frac{1}{4}$ " plywood

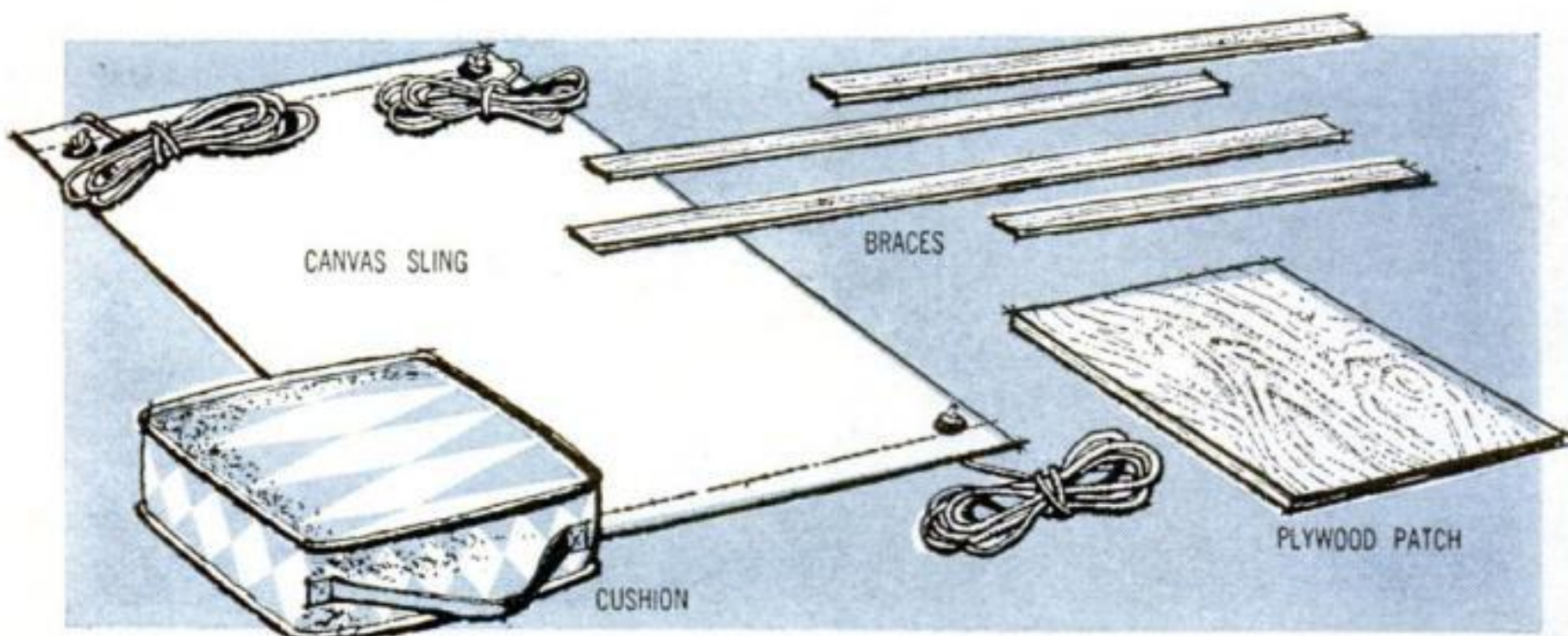
is used as a pressure plate either under or over the cushion. Short sticks, of which several lengths are included in the kit, are used to wedge the plywood patch in place by jamming them under seats.

To patch a hole from the outside of the hull, there's a canvas sling—simply an 18"-by-30" piece of canvas with a metal eyelet at each corner. Tied to the eyelets are ropes long enough to reach completely around the boat.

Optional extras. The cushion, plywood, canvas, and sticks are all you need to make a quick patch. To make it more durable, the kit should also contain a jar of nails for fastening the plywood to the hull, a hammer, and a small saw for trimming the plywood or sticks, or removing broken pieces of planking.

You may think a stapling gun is queer seagoing gear, but it's the handiest tool you can have for applying a canvas patch fast. There's also a tube of cement to insure a tight seal and a ball of string to keep the stapling gun and other tools on a safe leash.

Basic anti-sink kit contains only these four parts



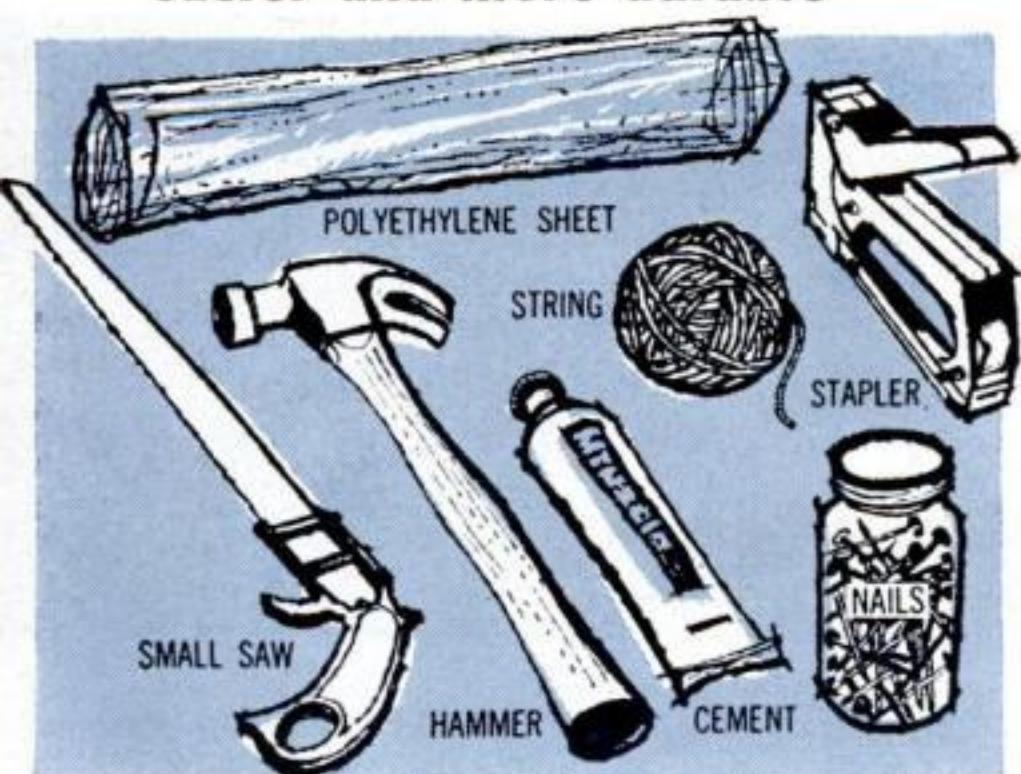


A quick fix like tying this canvas sling around a leaking hull may save a boat from sinking.

Another handy extra is a sheet of heavy polyethylene film. It will do double duty as a waterproof seal for your patch and a protective wrapper for your kit.

Seconds count. Breaks in hull plank-

Extra supplies make repairs easier and more durable



ing as large as 4" by 10" are common, so water comes in fast. What you do in the first few seconds may determine whether or not you stay afloat.

The first impact of an underwater obstruction may jar the boat so violently that you may not know immediately where the break is. To find it fast, remember: If you were planing at the time, any damage is probably amidships or aft since the bow is out of water. In a displacement hull that cuts through the water, damage will probably be forward.

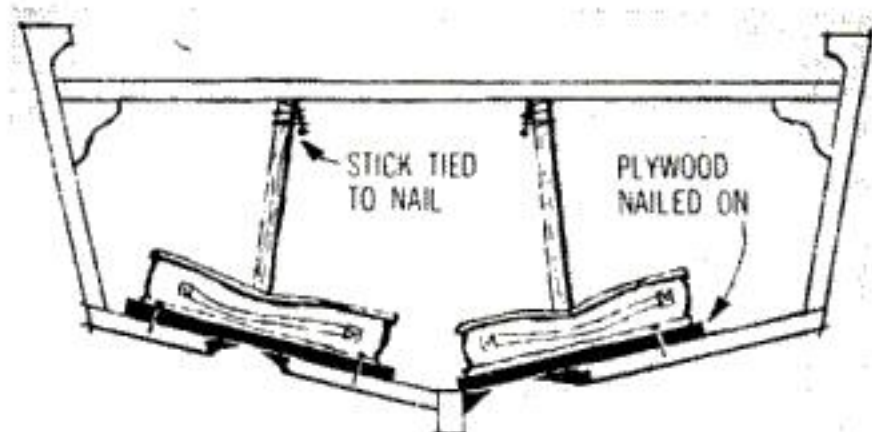
If you're within a hundred yards of shore, it's usually best to make a run for it. If you're out far, don't panic into blasting open the throttle—the extra speed will simply ram in more water.

There's one exception: If you're in a planing boat that's hit when it's *not* planing, you may be able to raise the damaged area clear of the water by getting the boat up to planing speed.

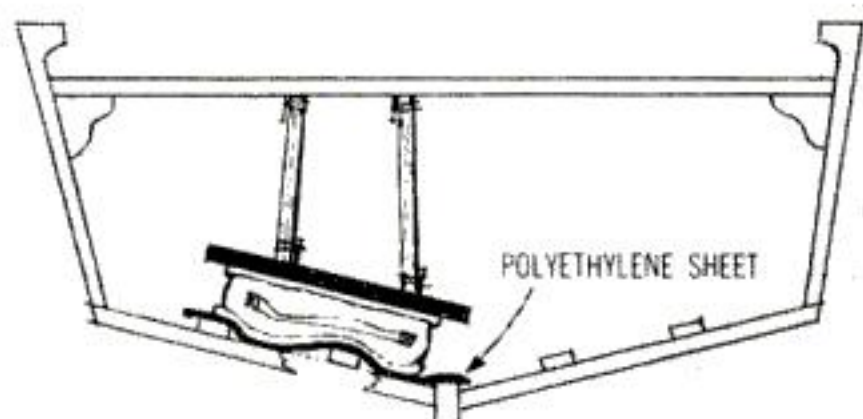
If the break is fairly high in the bow

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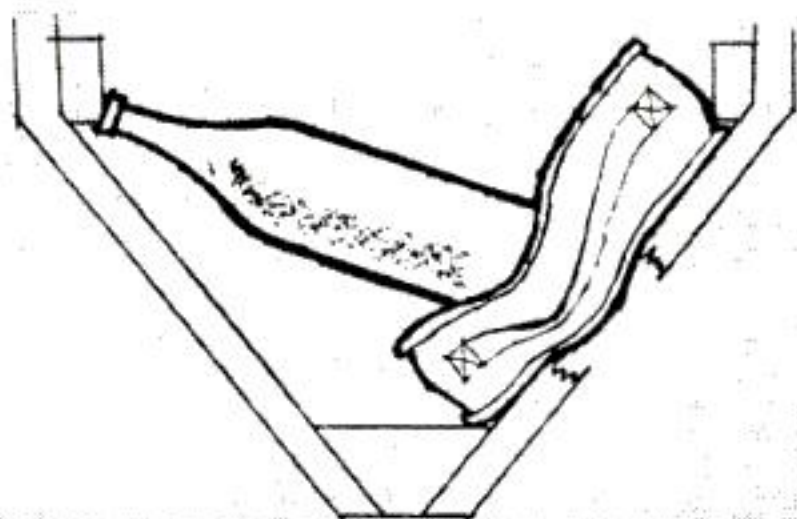
Four ways you can apply a patch on the inside of a boat



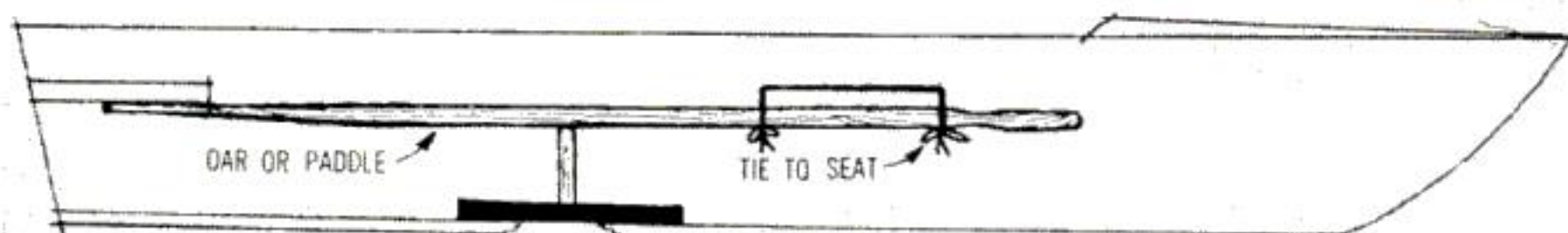
PLYWOOD PATCH can be jammed directly against hull if break is in a flat area. Use sticks wedged under seats to hold it tight. Lay cushion on top of plywood to adjust wedging action.



IF PLYWOOD WON'T LIE FLAT because of stringers or broken planking, pad hole with a cushion or clothing, then press plywood on top. Polyethylene sheet will help seal the hole.



IF HOLE IS IN THE BOW, hull may be too curved or narrow to permit use of plywood patch. In this case, wedge a cushion or wad of clothing into the hole with a stick or bottle.



WHEN YOU CAN'T WEDGE BRACES under a seat or deck, try this trick. Stretch an oar or paddle

or side, you can sometimes raise it out of the water by shifting your weight to the opposite side or end of the boat. Don't try tipping the boat, however, if a lot of water has already come in. The sudden shift of hundreds of pounds of water could easily swamp a boat.

Plug the hole. The small piece of plywood in the emergency kit will give you something to jam against broken planking. The sketches show several ways you can use it, depending on where the break is. If the boat has closely spaced ribs or stringers, cut narrow strips of plywood to fit between them.

You don't have to stop a leak completely. If you can slow it to a gallon or two a minute, you can keep afloat by bailing. A small Navy-type bilge pump will remove four to five gallons a minute, a two-quart can almost as much.

An important tip: Keep floor slats loose so you can remove them quickly to get at breaks in the bottom.

Patching for mileage. Once you see you can make it safely to shore, don't tamper with your repair. If you have a long run ahead, however, it may pay to improve the patch.

With a helper aboard, you can swim alongside the boat and smear on a 2" border of cement around the hole. Use a rubber-base adhesive like Miracle's—it sticks even under water.

Then haul your canvas sling over the cement around the hole. In a small boat, you can often do this from inside. If not, have a passenger hold one end or tie it to the boat while you slip the other end under the hull from outside.

It's best to staple the canvas to the hull around the hole and across the leading edge of the sling to keep it in place. The sling will hold fairly well, however, if you just pull it tight and tie it around the boat. It will even do a pretty good job without the cement.

between seats to provide backing and wedge a stick under it to hold the patch in place.

"WALKING" SUSPENSION

One of the most intriguing—and rewarding—features of Chevrolet's revolutionary Corvair is its superbly smooth, supple ride. The reason for it lies in a suspension system unique among U.S.-built compact cars: independent suspension at all four wheels.

Here's how it works: each wheel on a Corvair rests on its own deep coil spring, which absorbs road shocks independently of the other wheels. Say, for example, that you're cruising along a choppy dirt road and your left rear tire suddenly sinks into a rut. In any other U.S. compact car, the *right* rear wheel would react as violently as the left to that jolt—which is only natural, since both rear wheels are locked together on a single axle. But in a Corvair, the wheels are divorced from each other, so you virtually "walk" over the ruts.

This "walking" suspension helps keep your Corvair glued firmly on the pavement for extra traction and control on slippery roads. What's more, those resilient coil springs won't squeak,

which means a quieter ride. And Corvair's independent suspension cushions the car's overall weight for a soft, comfortable way of going.

This 4-wheel independent suspension is, of course, a tremendously important advance in the design of compact cars. A five-minute turn at the wheel will show you just how important. The man to see is your Chevrolet dealer—and there's no better time than now.... Chevrolet Division of General Motors, Detroit 2, Michigan.

Technically speaking, Corvair is probably the most fascinating car to come down the U.S. pike in the past 49 years. Here are some of the engineering advances you'll find: an air-cooled "pancake" six engine, mounted in the rear ... unit construction ... an amazing unit combining engine and transmission in one compact package.

corvair[★]
BY CHEVROLET



New Ideas in Photography

Drama for 8mm Movies! New Kodak Movie Camera Zooms Scenes In or Away

Now you can give your home movies the same dramatic zoom effects you see in theater movies or on your TV screen. Catch your subject in motion—then zoom in for a close-up without interrupting the action or changing your position!

The remarkable new Kodak Zoom 8 Camera (Automatic $f/1.9$) features a variable focal length lens. As you slide the lens barrel forward or back, it seems to “shrink” or “stretch” the distance to your subject.

In shooting sports scenes, for example, you can get an over-all view of the action, then zoom in on one player. When you project the scene, the player comes closer and closer, growing bigger on your screen.

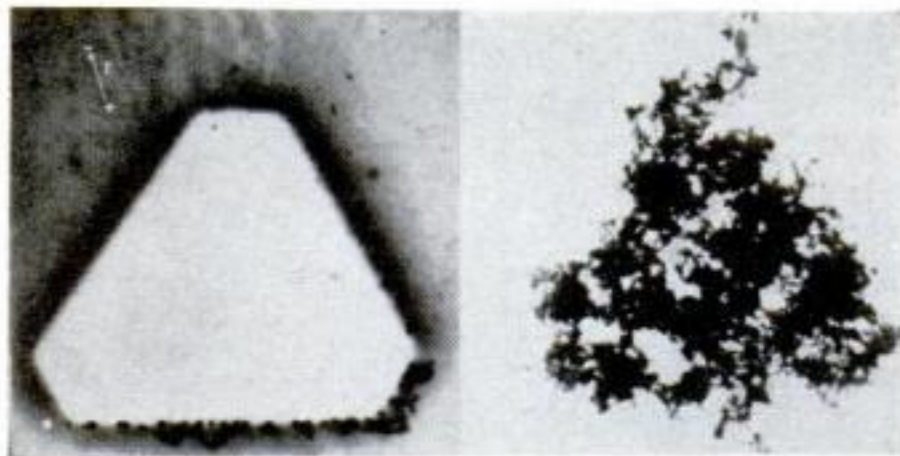
You can also use the Zoom 8 lens to get the same wide-angle, regular, or telephoto effects that used to require a 3-lens turret camera. Each field is outlined in the telescopic viewfinder.

Another great feature: built-in electric eye adjusts the fast $f/1.9$ lens automatically for correct exposure. And the viewfinder eyepiece adjusts for your own eye.

Enjoy a new kind of action-packed movies with the Kodak Zoom 8. An unusual value at only \$139.50, or as little as \$14 down. Many dealers will take your old camera in trade.



Kodak Zoom 8 Camera brings faraway subjects up close without stopping the action.



Enormously magnified crystal of silver bromide (left) in 10,000-volt-per-centimeter field. It is just starting to develop; note tiny metallic silver specks along bottom. At right, fully developed silver network. Photos are of electron-microscope images.

Film Now Investigates Film, World's Most Sensitive “Amplifier”

Scientists are now using photography itself—and the electron microscope—to learn more about the inner behavior of photographic film.

They have found that when photons, the “energy bullets” of light, strike the silver halides in film, electrons are liberated. These electrons, in turn, trigger a development reaction a billion times as great as the photons’ original power!

Such advanced research into the physics of film emulsions gives Kodak new knowledge to create faster, finer grained films for amateur and professional use.

from Kodak

Screen Arrow Adds Showmanship to Automatic Slide Shows

Now when you show slides to guests you can point out details on your screen without leaving your chair for even a moment.

Lift a finger-tip control on your automatic Kodak Cavalcade Projector—and a shadow arrow appears on the screen. Up, down, right, left—the arrow moves as you choose, to point out details you want to discuss.

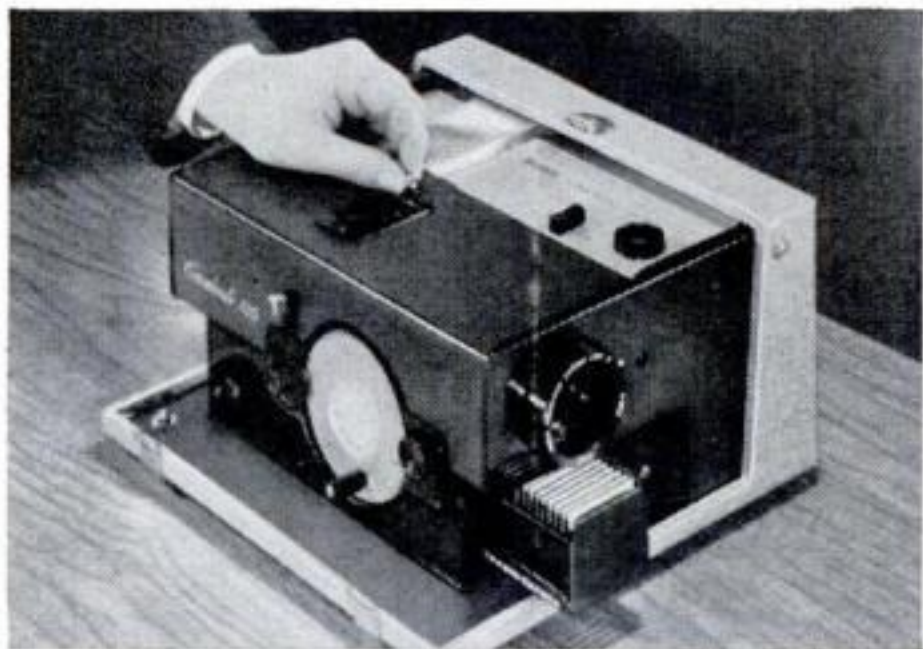
And all the time, your Cavalcade is changing slides automatically at the pace you chose—as many as 40 slides in sequence. Instant change between slides, too—no long drag or dark screen!

Controls let you hold, repeat, or skip any slide—or lift out any slide with a finger-tip ejector. And each slide is held in its own steel protector, for smooth showing, no jamming.

Take some slides along when you ask your dealer to demonstrate this wonderful projector. With $f/3.5$ lens, only \$124.50, or \$12.50 down.



Arrow points out details as you talk about them.



Control for arrow is easy to reach, easy to use.

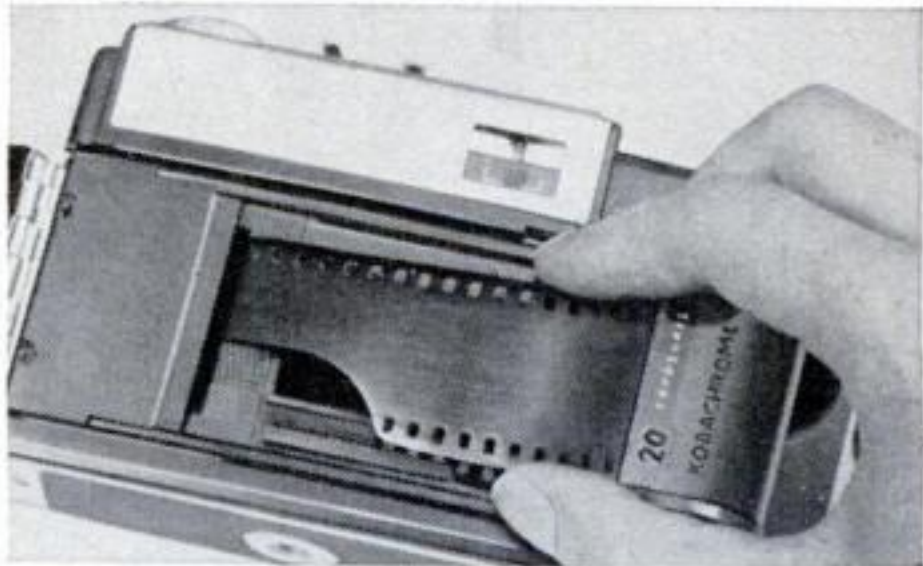
Ingenious Film Loading System Does Away With Take-up Spool

Here's the quickest, simplest 35mm film loading ever devised. No threading or hooking on a take-up spool. *There isn't any spool.*

With the Kodak Signet 80 Camera, you just drop the film in, start the tip into a slot, and close the camera back. As you advance the film, it feeds smoothly into an expansion chamber.

Such ease of operation is typical of the Signet 80. Exposure control is easy—the built-in light meter ends guesswork. Focusing is easy, rangefinder couples to all lenses. Film advance is easy—two thumb-flicks!

This is truly the camera with the skill built in. See for yourself. With 50mm $f/2.8$ lens, only \$129.50, or as little as \$13 down.



Loading so easy you can do it blindfolded!

35mm wide-angle lens for Signet 80, \$57.50; 90mm telephoto lens, \$69.50; multi-frame finder, \$17.50. Other aids available for ultra close-ups, sports, even photomicrography.



Prices are list, include Federal Tax, and are subject to change without notice.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

SEE KODAK'S "THE ED SULLIVAN SHOW" AND "OZZIE AND HARRIET."

Kodak
TRADEMARK



Light plane record holder uses Champions! Max Conrad set a new endurance record for single-engine, light planes last June . . . 7,668 miles non-stop! His Lycoming-powered Piper Comanche was sparked by Champions.



Outboard record holder uses Champions! Hugh Entrop holds the world's outboard motor record with a dazzling 107.8 miles per hour. His stock Mercury outboard was powered by Champion spark plugs.



Land speed record holder uses Champions! Mickey Thompson set a new American speed record of 363 m.p.h. at Bonneville Salt Flats last October. His car's four Pontiac engines were all sparked by Champions.



Indianapolis record holder uses Champions! Rodger Ward set a new record at Indianapolis last year at 135.8 miles per hour. Rodger, like 9 out of 10 race car winners, uses Champion spark plugs!

Q. Why do the record breakers, in field after field, use Champion spark plugs?

A. Because they know they can depend on Champions to wring every bit of performance out of every drop of gas. Your car will perform better, too (and save money on gasoline) with new Champions. Put in a set every 10,000 miles!

*Worn spark plugs waste lots of gas—
so check your plugs every 5,000 miles!*



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**After
100,000
miles of
driving,
I know...**



My Car Won't Rust or Rattle

***Ordinary roofing paint inside this 10-year-old veteran
keeps it rust-free and riding as quietly as on a cloud***

By Richard H. Boster

EVER step into an acoustically lined telephone booth and feel the silence surround you? That's how my car feels since I coated interior metal with \$5 worth of thick asbestos roofing paint.

This luxurious, silent ride came as a side benefit when I decided to completely rustproof the body of my six-month-old car back in 1950. Since then, I've driven the car 100,000 miles through snow, ice, road salt, and slush, and parked it out of doors when not in use. Today, the body metal shows no trace of rust and the car feels as tight as ever.

To protect and silence your car as I did mine, the most important thing is to cover every inch of interior metal below the level of the windows. This means removing all interior trim, upholstered panels, seats, and floor mats. But don't rip the entire car apart at one time. You can do a little at a time. Start with the doors. When they're done, pull out the

seats and floor mats, and coat the floor.

Vacuum or brush out dust from all areas and wire-brush any rust spots that may have already started. Apply a heavy coat of the roofing paint wherever you can reach with a paintbrush. Inaccessible spots can be coated by thinning the paint with mineral spirits and spraying it generously, using a vacuum-cleaner spray attachment or insect sprayer.

Additional sound insulation can be added by laying pieces of felt rug padding over the wet coating. Trim the padding about 2" from each side of the car so the original floor mats will lie flat. Don't place padding in door bottoms, and make sure the paint doesn't clog the drain openings. Clear them with an icepick before you put back the panels.

Remove the mat and side panels from the trunk and coat the entire compartment as well as the inside of the deck lid. Then go forward and coat the fenders, firewall, and splash shields inside the engine compartment.

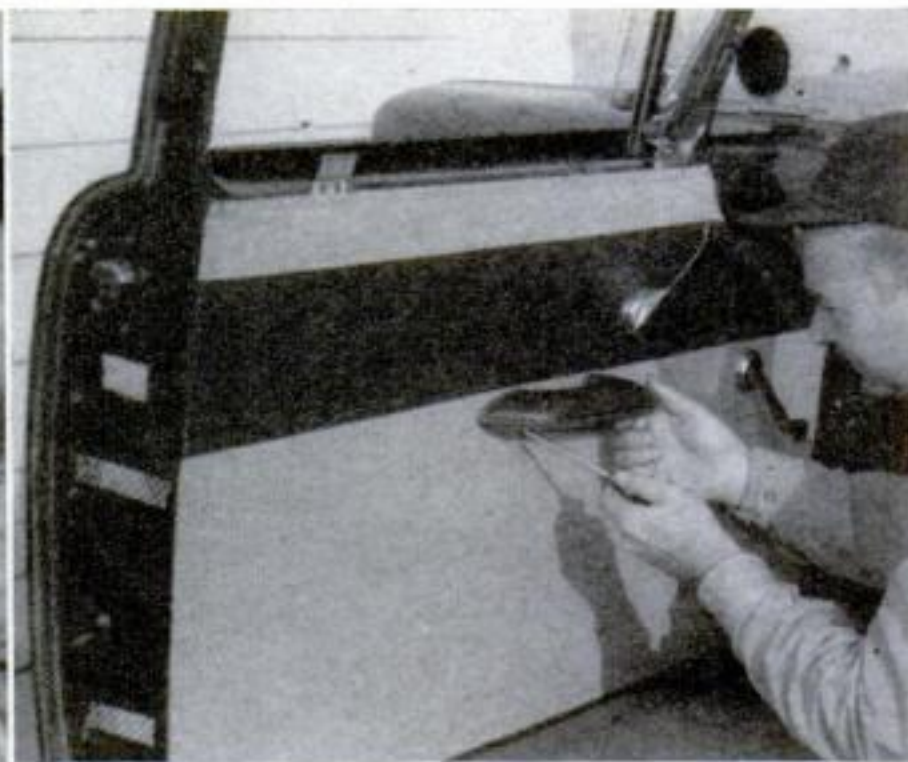
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How to remove interior trim to coat the doors



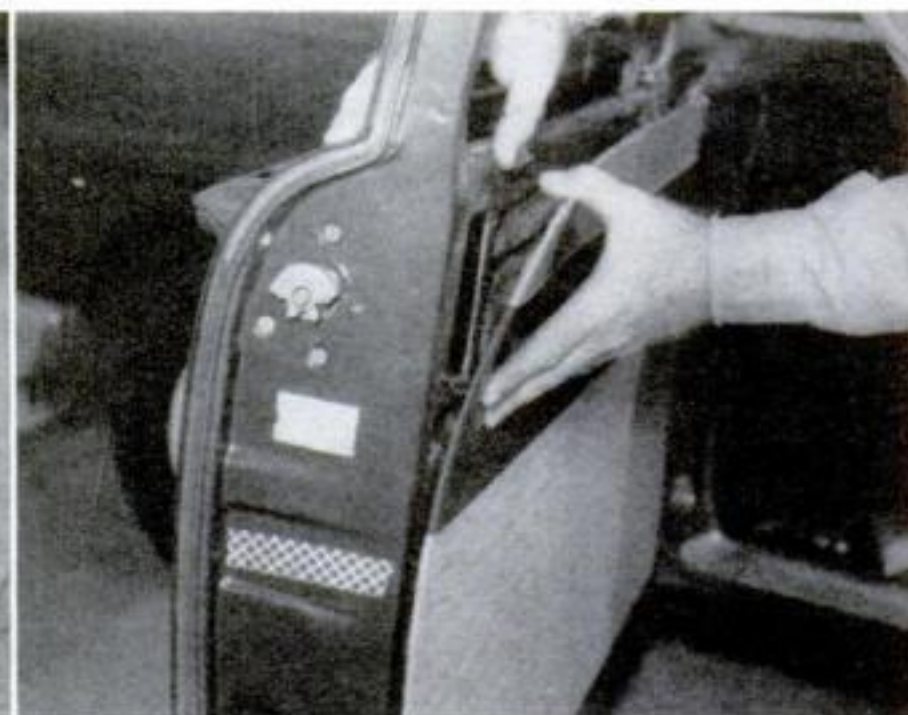
REMOVE SCREWS (usually Phillips-head) from the frame around the window. Pull frame out at top of window opening and lift it upward.



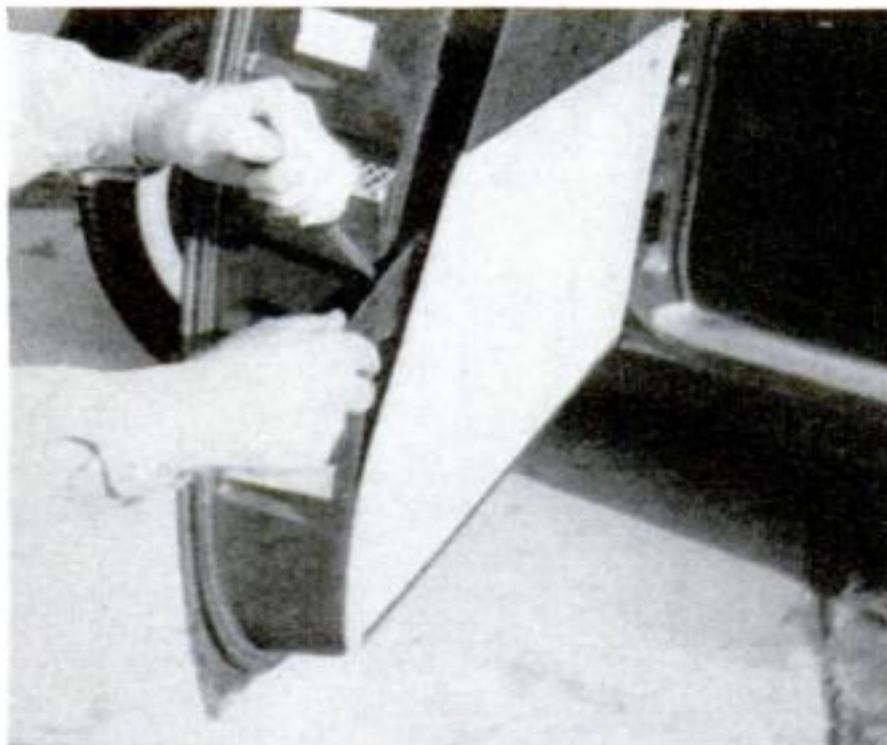
TAKE OFF ARMREST by removing two long machine screws which are usually concealed in recesses in the underside of the padding.



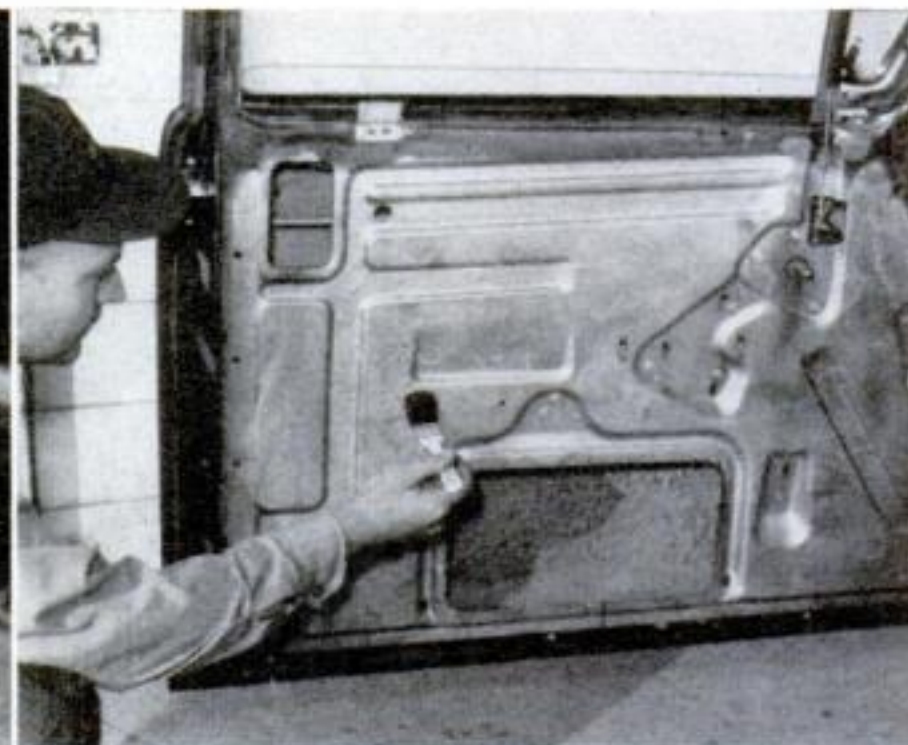
REMOVE DOOR HANDLES by pressing the panel and escutcheon plate inward and pushing out the retaining pin or hairpin-shaped spring clip.



LOOK FOR SCREWS in panels (often at corners), remove them, and pull panel gently away from door at top edge. Panel should not be forced.



INSERT PUTTY KNIFE between panel and door, and pry panel away. Work knife as close to spring clips as possible to avoid cracking panel. Use the same procedure on cowl panels.



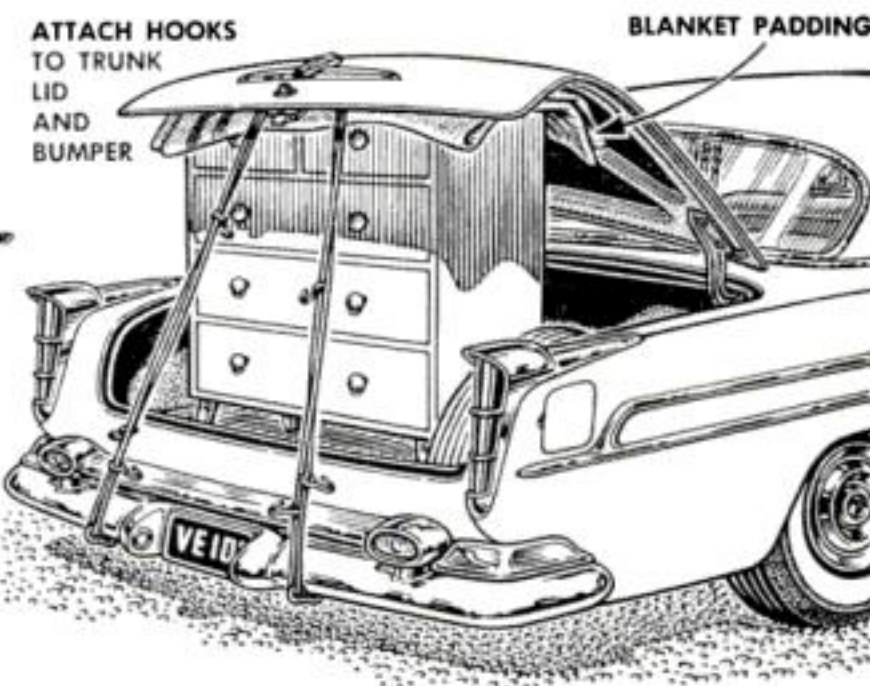
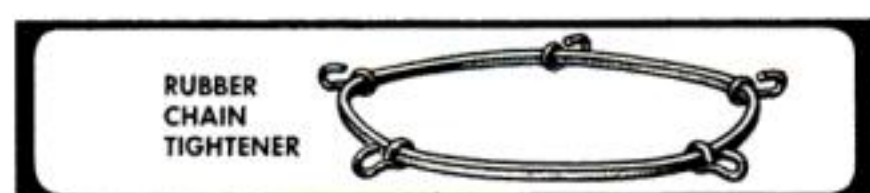
GET INTO ALL THE CORNERS, leaving no bare spots where rust can start and work beneath the coating. If brush won't reach, thin the paint and spray it in with a vacuum-cleaner sprayer.



Hints from the Model Garage

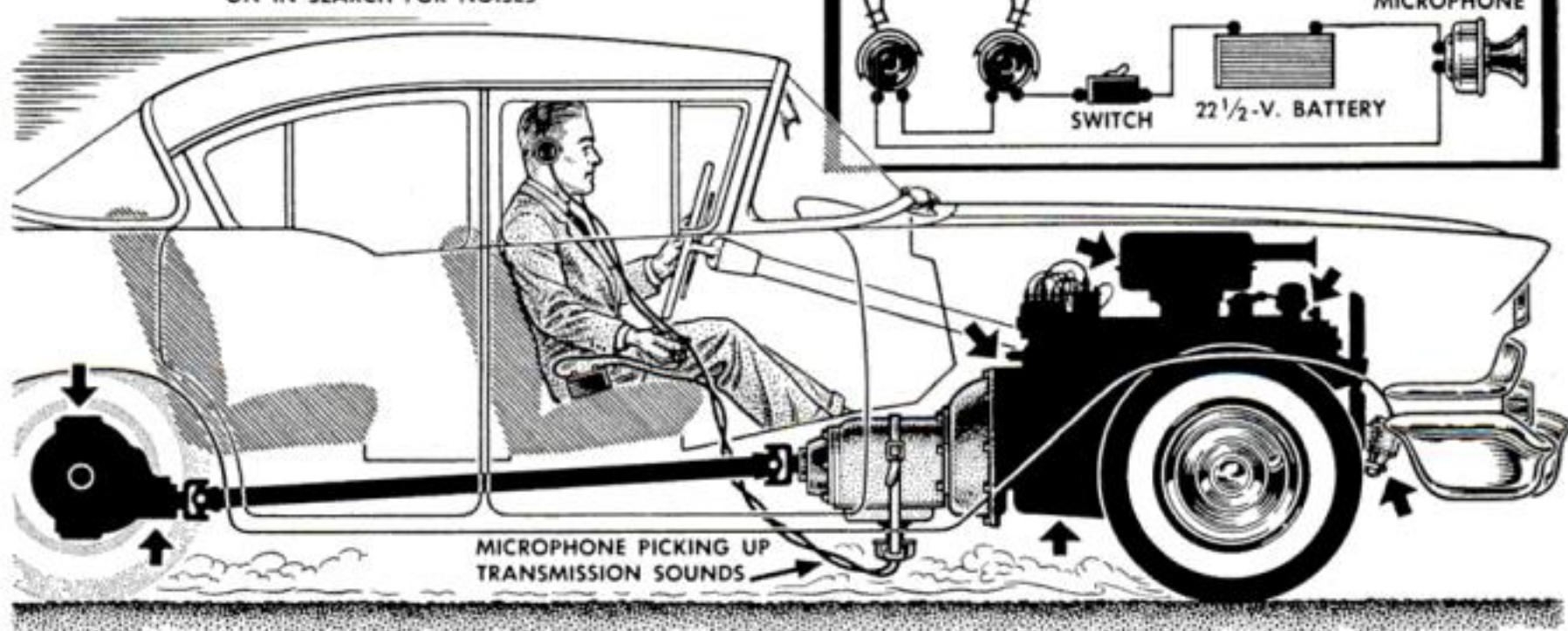


Noisy hubcaps can be silenced by coating the entire inner surface with body undercoating. Brush the material out to the edge of the cap and over the clips that hold it in place. This insulates the cap at all places that touch the wheel.



Like a big rubber band, a rubber tire-chain tightener can be used to keep an open trunk lid from flying up and down when hauling large objects. Clip several of the hooks to the underside of the lid and to the bottom edge of the bumper.

BLACK ARROWS INDICATE SOME OF MANY PLACES WHERE MICROPHONE MAY BE STRAPPED ON IN SEARCH FOR NOISES

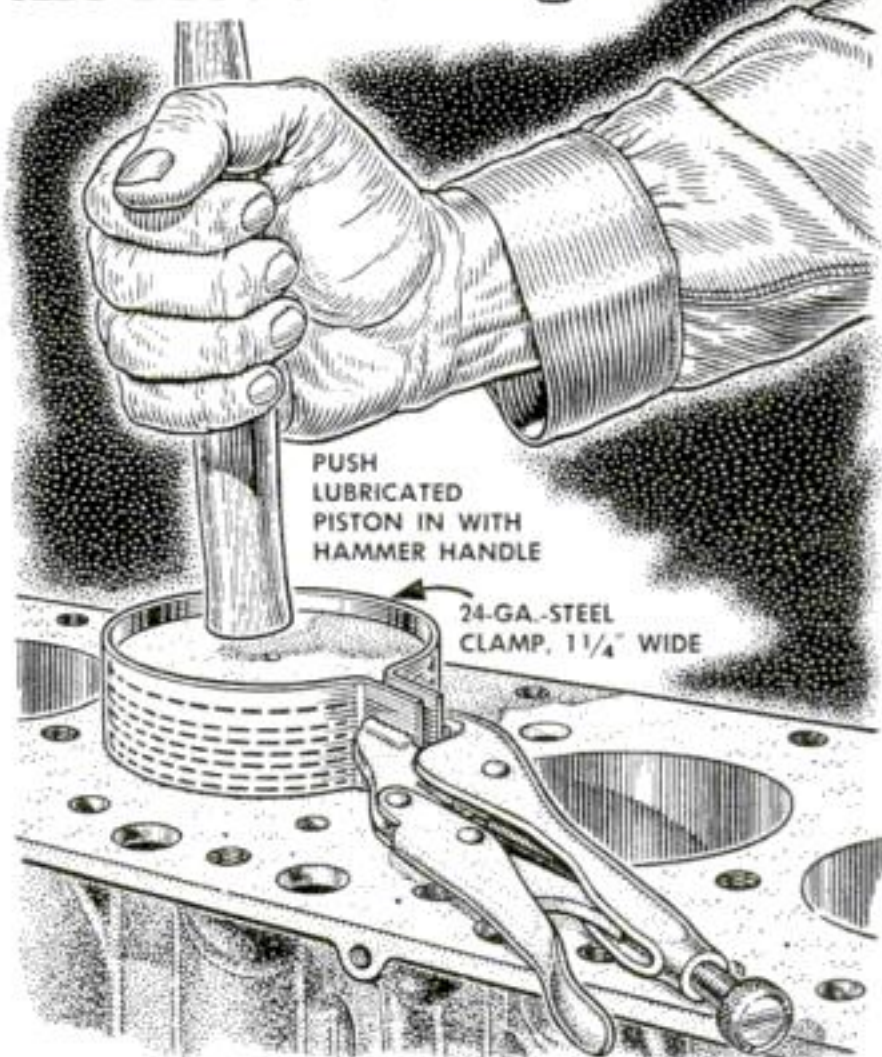


Hard-to-locate noises that occur only when a car is in motion can be pinpointed with this inexpensive microphone outfit. Wire a carbon microphone—the type found in surplus telephone equipment—to a 22½-volt battery and a set of low-

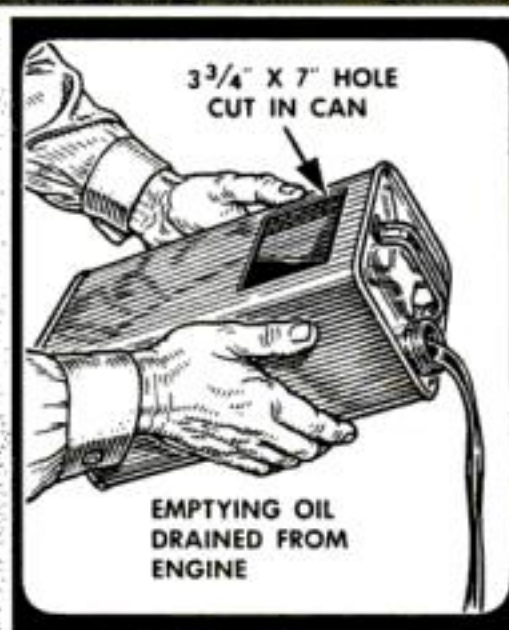
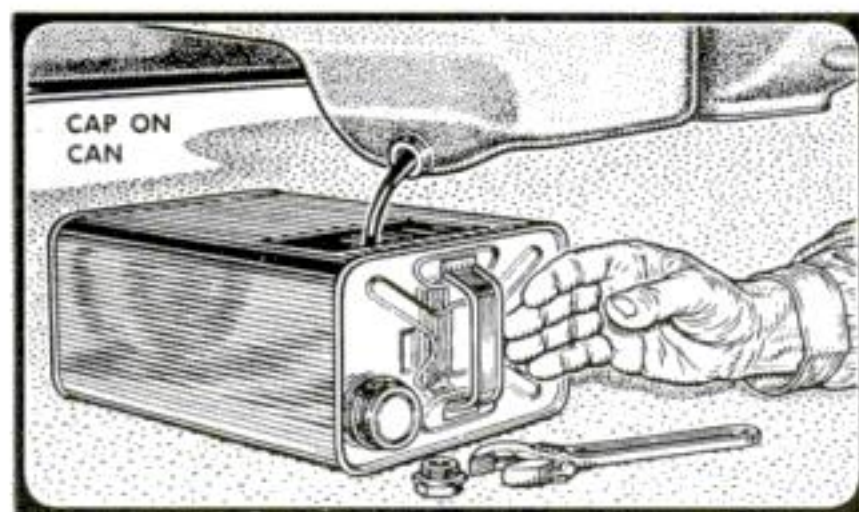
impedance headphones. Strap the mike in different positions in the suspected area and listen while you drive. When the noise comes in loud and clear, you've found its source. The mike will locate rattles, noisy gears, and clicking valves.

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More Hints from the Model Garage



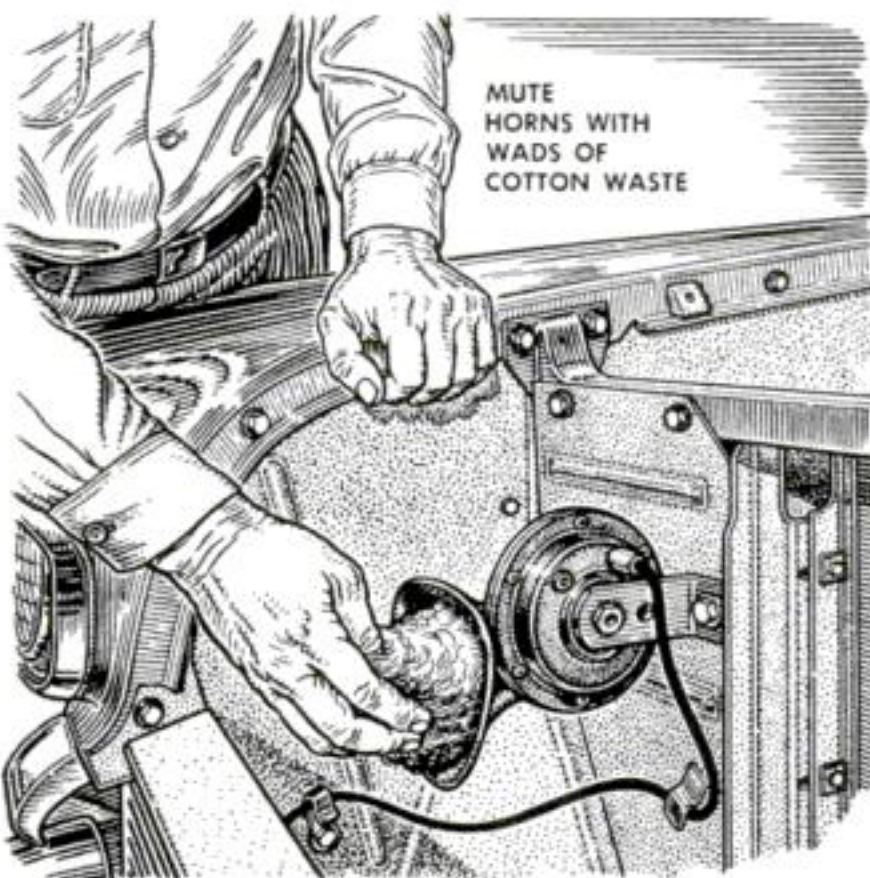
A workable ring compressor can be made from a 1 1/4"-wide strip of steel with a tab bent at each end. Place the rings in their grooves, wrap the strip around them, and compress them by squeezing the tabs together with cam-locking pliers.



You can drain old oil into a 10-quart can and carry it away without spilling. Cut an opening in the can near the top and lay it on its side. When the can is held upright, the five quarts or less of old oil won't come up to the opening.



Lacking a rubber mallet to drive a wheel cover or hubcap into position, you can still save your hand from a bruising. Use the rubber heel of your shoe. Light blows with the shoe will seat a wheel cover in seconds without damaging it.



When repairing or adjusting a horn, you can avoid irritating the neighbors and spare your own ear drums by stuffing cotton waste into the horn openings. The waste will mute or quiet the horns without affecting their tone and pitch.

the "CLASS" of '60



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ROCHESTER CARBURETORS

Gus Plays with Fire

By Martin Bunn

"**W**HERE is that thread-stripping, nut-rounding car wrecker you call your boss?" bellowed someone just inside the Model Garage door.

Stan jumped. "Who the—oh, it's you, Chief Maloney."

Gus appeared from around a car, wiping his hands. "Sure enough, it's the loud-mouthed smoke eater. You still on the job, or is it safe to cut down on my fire insurance? How are you, Mal?"

"Fine, till I think what you'll charge the town for a small job I need done on my car," said the Chief.

"We'll take it out of your salary. Don't know when you've last earned it by going to a fire. What job?"

"Tune-up. New points. Gap the plugs. And I want it done now."

Gus's grin faded. "I'd say yes, Mal, but Stan has to finish Joe Stanton's car for an important trip, and I've promised to reline the brakes for Mrs. Munsey while she takes her boy to the doctor this morning."

Maloney frowned. "Can't you put her off? That's no emergency job."

"Nor is yours," said Gus. "That slab-wheeled red crate of yours will haul you any place you need to go today. Bring it in tomorrow, huh?"

"Okay, tomorrow." But Maloney's good humor was gone.

"For Mrs. Munsey," said Gus seriously, "it is an emergency. She drove 20 miles with a sick youngster, and has nobody to leave him with if she has to come another day."

"Okay, okay. Do my car tomorrow," agreed Maloney.

As the fire chief left, Stan peered up from the crawler he lay on. "You and the Chief sure shoot the breeze. Before I saw who it was, when he called you a left-handed mechanic—"

"Go on," urged Gus.

"I thought the guy meant it!" finished Stan, and rolled under the car to dodge a wad of waste Gus threw at him.

After sending Mrs. Munsey on her way with better brakes, Gus was phoning a parts order when a banshee whistle penetrated the office. He finished the call and walked out.


"There goes the whistle for the volunteer reserves," he remarked to Stan. "Mal must have a big one."

A car siren screamed a block away. "That's the third one," Stan said. "Two went by while you were inside."

"Then Mal is already there. Kidding aside, he's right on the ball."

"Maybe he'll call you out," suggested Stan, grinning.

It was then that the phone rang.



A hand seized Gus roughly, almost jarring the precious piece from his grasp. "Told you to get out!" Maloney shouted.





With its front end against a brick wall and the yard office just behind it, the tank truck couldn't be towed out.

THE very air seemed ablaze over Conwal's Lumber Yard when Gus braked to a quick stop just inside the gate. Under a pall of resinous smoke, stacked lumber burned all along the back fence. Maloney was beside Gus immediately.

"It's a bad one, Gus. I need you." He pointed through the smoke haze to a huge wheeled bulk. "Jensen's gas truck, jammed in where we can't tow it, and the engine's dead."

The tank truck, its front against a brick wall, stood wedged between enormous piles of lumber. Directly behind it was the yard office, blocking any hope of towing it backward or from the front end of the driveway. The only point from which towing could have been done was inside the blazing yard itself.

"That's where the underground tank is," Maloney explained. "Jensen backed in, delivered gas, and started to drive out. Just then his engine conked out, so he coasted into that slot to leave the driveway clear."

The Chief grimaced. "That truck is almost full of gas. The fire won't give us time to move the lumber, and we can't tow the truck out. If it goes up, it could take the whole block along."

Gus nodded. Across the street and behind the yard were many modest homes.

"Didn't know till now," Maloney added, "that Jensen left the ignition on. Now the battery's too gone to turn it over. Got an extra?"

"It's on charge," snapped Gus. "Got any booster cables? Mine aren't long enough to get in there."

"Couple in the pumper," said Maloney, and went off. But hope sank when Gus saw the Chief's cables. Even with Gus's added, they'd be far too short to connect the truck's battery with the one in the wrecker.

Gus tried to recapture what he knew of the electrical system of this make of truck. Was the negative side grounded, as in his wrecker? An even chance . . .

"Mal, grab this file and clean a spot my bumper can contact. Get a man to run the wrecker against it and keep the engine at fast idle. Give me a man in the gas truck, too."

Maloney took the file and started roaring orders. Gus clamped the four booster cables end to end, clipped one to the wrecker's ungrounded battery terminal. Holding the other end, he sidled in between the lumber stack and the gas truck.

The truck hood was up, but the corroded battery terminals gave no clue as to which was positive, which negative. Looking back, Gus saw a fireman drive the wrecker up to nudge the rear of the truck. When it was in firm contact, Gus brushed the cable end against the ungrounded terminal of the truck battery. Only a modest spark flew.

"Polarity's okay," he muttered, and nodded to Maloney in the truck cab. As Gus clamped on the booster cable firmly, the starter churned over.

THERE was not even a cough from the engine. Yanking a plug cable off, Gus held it near the block. No spark jumped. He did the same with the high-tension-coil wire. It too was dead, and he signaled the Chief to stop cranking.

As the noise of the starter died, a fireman shouted above the snap and roar of wind-fed flames. "Wind's shifting, Chief. Other end of these piles is already afire."

Maloney crawled across the cab. "Gus! What're chances of moving it?"

"Know in a minute. Leave the switch

CONTINUED



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The usual extended tip spark plug (left) has a long ground electrode that can burn or wear away under severe operating conditions.



The new AC Fire-Ring Extended Shell Spark Plug has the short, sturdy ground electrode design that reduces vibration, burning and breaking off, assures superior performance.

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You get faster, surer starts and cleaner burning full power performance throughout the entire life of the spark plug.

If your car calls for extended tip spark plugs, ask for this newest development — new AC Fire-Rings with *extended shell*.

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

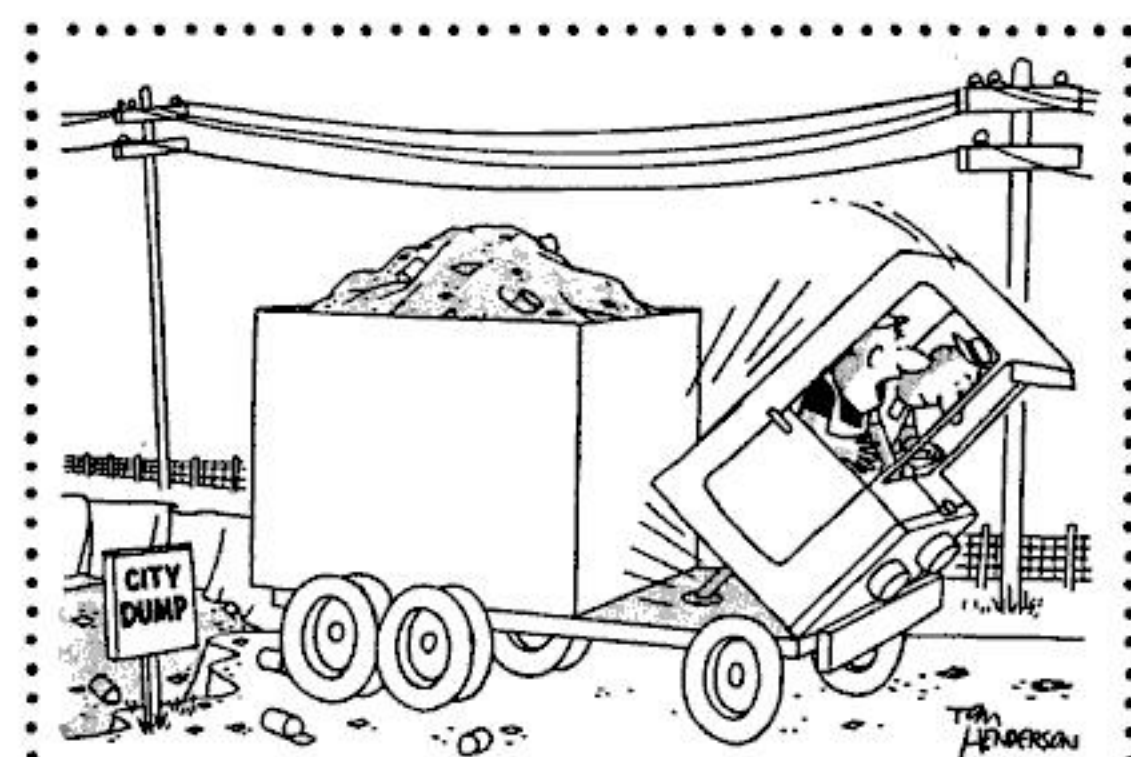
AC PRESENTS THE ART CARNEY SHOW,
NBC-TV, April 8

on." Snapping the clips off the distributor, Gus lifted the cap and rotor. With the coil cable again held near the block, he snapped the breaker arm off the point. A lively spark jumped between cable and block.

"Switch off!" shouted Gus, and choked as smoke engulfed him and the engine. When it cleared, he spotted a chip of fiber lying in the distributor. He knew what it was at once—a piece broken off the rubbing block that bore on the cam. Without it, the cam couldn't open the points. A rare happening, but here it was deadly.

Eyes stinging, Gus loosened the nut, pulled the breaker arm off its post. He felt Maloney at his elbow.

"Got another?" asked the Chief.



"No, no, Horace—the other button!"

"Not here—maybe not even in the shop. It's an old truck." Useless to try to substitute an arm from the wrecker or any modern car, Gus knew.

"Fire's blowing this way. I've ordered the houses evacuated. Get out!" Maloney disappeared in a swirl of smoke. Coughing, Gus took a pencil stub from his pocket, thumbed open his penknife, and sawed a quarter-inch length off the wooden hexagon. But a fit of coughing sent the blade askew. The fragment flew off.

He laid the pencil on the truck fender, sawed off another bit. Half of it splintered away. Prying the lead out of the other half, he set it into the channel of the tiny contact arm.

It fell out. Savagely Gus sawed off a slightly longer bit. Almost unable to see,

he wedged it into the channel of the arm, its groove over the stub of broken fiber.

A hand seized him roughly, almost jarring the precious piece from his grasp. "Told you to get out!" Mal shouted. "Pile is blazing at the tail end of the tank now."

Gus coughed. "Spray the tank. A minute—I may get it to work."

He set the arm on its post. The pencil-wood block stood clear of the cam. Eyes streaming, Gus estimated the cam lift, backed the stationary point off a bit, slipped on the rotor and cap. He heard Maloney shout an order, and the wrecker's engine roar increased. Coughing uncontrollably, Gus signaled Maloney in the truck cab. The starter ground. The engine fired at once.

Unclamping the booster cable, Gus snaked back out of the narrow aisle. Maloney backed the truck out almost before he was clear. Its tail clipped a pile of blazing two-by-fours, scattering them like burning matches. Three hoses arched in to wet the sparks.

Yanking free the booster cables, Gus let them fall and jumped into the wrecker. With split-second timing, the fireman at the wheel backed out in advance of the oncoming gas truck. In its cab, squinting through the smoke, Chief Maloney grinned like a triumphant demon.

WHEN a bright red coupe pulled into the shop next day, Gus shook his head in mock disgust.

"Send him away, Stan. It'll spoil my lunch to work on that gaudy crate."

"Yeah? Don't know what's got into me—trusting town property to a half-brained mechanic who forgets his booster battery," retorted Maloney.

Stan looked at Gus. "I thought the newspaper called you *both* heroes."

"Cheap publicity!" snapped the Chief. "Now, about that tune-up."

Gus looked thoughtful. "Afraid not today. Got to get Mrs. Smith's car done so she can go to a bridge tournament—" He broke into a grin. "Only kidding, Mal—after yesterday, I guess you rate top priority at the Model Garage."



Weight-saving, welded construction helps the Falcon go up to 30 miles on a gallon of gas.

Why does the Falcon have a welded single-unit body and bolted-on front fenders?

Welded, single-unit construction gives more usable space, great strength, an unusually quiet ride. That means the Falcon can be compact outside and yet carry six big people in comfort. And this *lightweight* method is one big reason why the Falcon goes up to 30 miles a gallon.

Bolted-on front fenders cost less to replace. In fact, just about half what welded-on fenders cost. They speed repair jobs, too, to save you time *and* money! That makes them *right* for an economy car.

It's the same with Falcon's single carburetor that costs half what a dual system costs to replace. And it's much easier to adjust since it does not require synchronizing with a twin.

But a *true* economy car must have fine-car quality to keep resale value high. And that's where the Falcon shines brightest!

Try these simple quality tests. *Push* your hand against the Falcon's "ceiling." You'll find a deep layer of sound-conditioning material. *Feel* the texture of that beautiful upholstery. *Inspect* the workmanship of each bright metal detail. That's quality you can see and feel.

Economy where it *pays*... quality where it *counts*! That's the Falcon... easiest car in the world to own.

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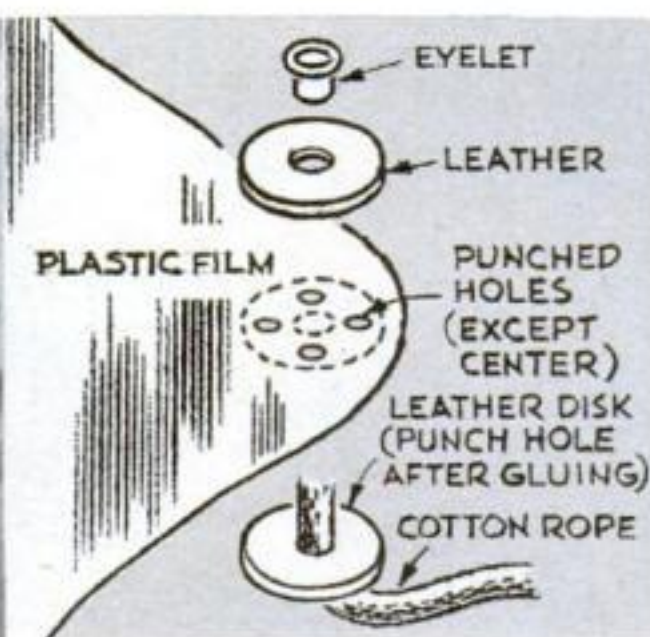
Falcon
FORD DIVISION, Ford Motor Company,

Short Cuts and Tips

FROM PS READERS

Controlling Moles with Mower Exhaust

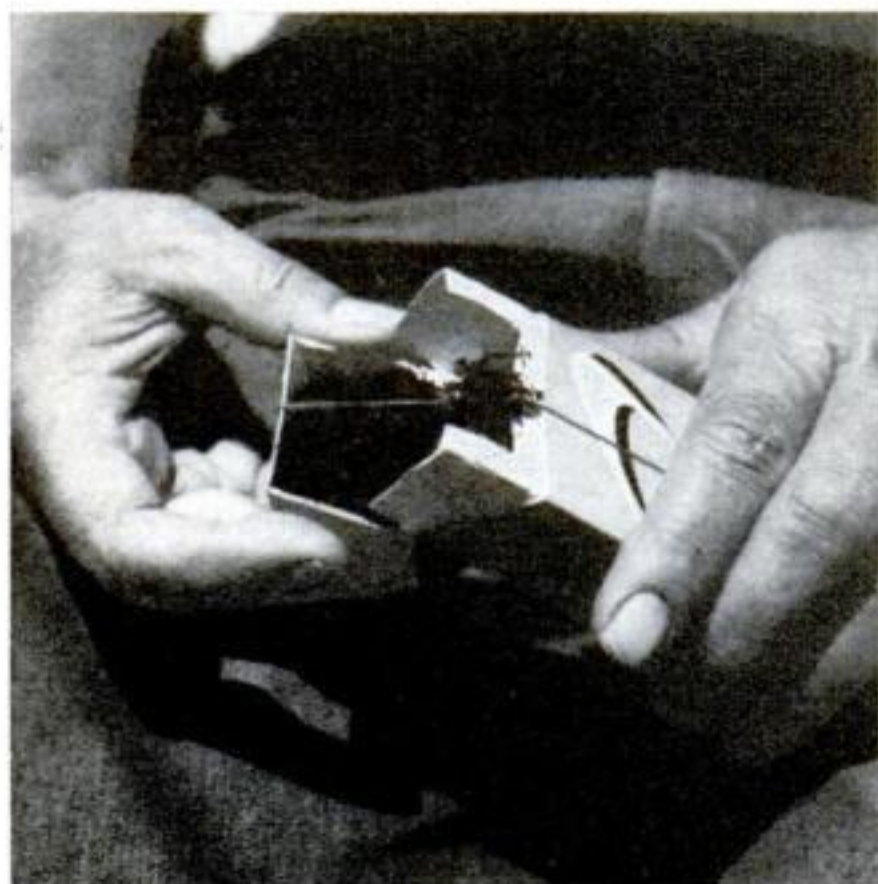
A SHORT hose on the exhaust pipe of a power mower puts a quick finish to mole damage. Hold the other end of the hose in the mole burrow while the engine is running.—O. S. Sanderson, St. Johnsville, N. Y.



Plastic Shop Apron Cut from By-the-Yard Film

BUY 15 cents' worth of four-mil polyethylene plastic, and you have the makings of an apron to protect your clothing while working in shop or darkroom. Use an old apron as a pattern for cutting the

plastic. So that neck and waist tapes don't rip out, attach them through leather disk eyelets, as shown. Run the cords through, and hold them with knots tied inside.—Walter E. Burton, Akron, Ohio.

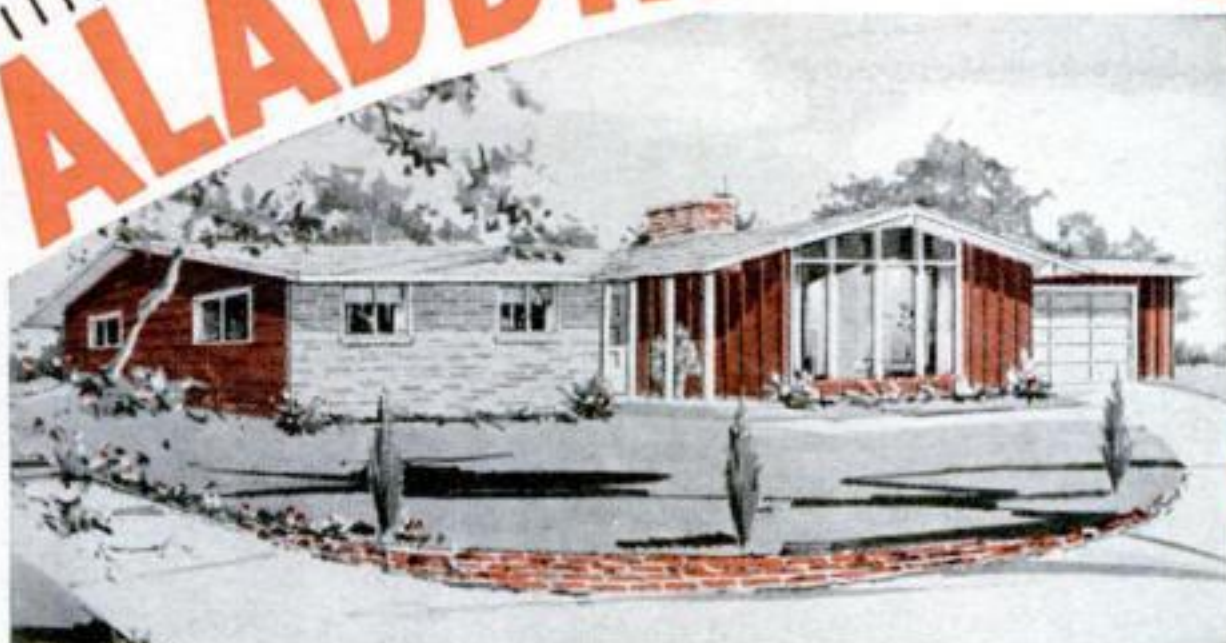


Box for Holding Bait Worms

A FISHERMAN can easily convert a flip-top cigarette box into a worm carrier. Punch it full of pinholes, line it with wax paper, and half fill it with moist florist's moss or the organic material in which worms come packed. With the lid held down by a rubber band, the box fits into a shirt pocket. When you need worms, shake them out into the open top.—W. S. Head, El Cajon, Cal.

►►►FOR a cool effect from your fireplace in the summer time, give it a coat of whitewash and substitute greenery for the andirons and logs. Come fall, the whitewash can be scrubbed off with hot soap or detergent suds and a stiff brush.

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RUSTMASTER PRIMER



ORDINARY PRIMER

PROOF OF BETTER ADHESION — Rusted metal sheets were coated with primers and finish coats and exposed to weatherometer at 95 degrees and 95 per cent humidity for 300 hours. They were then subjected to severe bending. Ordinary Primer cracked and broke away from surface. RUSTMASTER showed little sign of stress, revealing far greater flexibility and adhesion.



RUSTMASTER PRIMER



ORDINARY PRIMER

PROOF OF BETTER ENDURANCE — In salt spray test, metal panels were coated with primers and finish coats and scratched through to bare metal. Panels were then subjected to continuous salt spray for 500 hours. Ordinary Primer had severe blistering and under-film corrosion. RUSTMASTER restricted corrosion to scratched area, proving higher corrosion-resistant qualities.

New paint penetrates deep down into metal pores, forces out corrosive moisture and air

RUSTMASTER, the paint developed to combat the \$6 million annual corrosion losses of industry, can now beautify and lengthen the life of metal surfaces in and around your home.

RUSTMASTER can be brushed right over rusted surfaces—penetrates deep down into metal pores, driving out corrosive moisture and air.

Secret to the remarkable protective action is a special surface wetting additive.* Operating on a principle similar to modern detergents, RUSTMASTER forces right through rust layers to the metal beneath.

RUSTMASTER PRIMER is easy to apply by brush or with the convenient spray can. It dries overnight ready for finish coat.

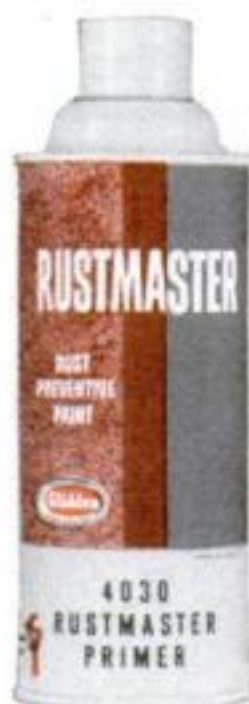
Insist on the finest in metal protection. Ask your paint dealer for RUSTMASTER, the paint proved in industry. Primer and nine attractive finish coats are available plus RUSTMASTER GALVANIZED PRIMER for aluminum and galvanized metal.

*Patent Pend.



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RUSTMASTER also sold by dealers for CLIMATIC
HEATH & MILLIGAN • ROYAL • MOUND CITY



U. S. Begins Search for Beings in Other Worlds

[Continued from page 69]

NRAO's 85-foot dish, one of the country's largest steerable radio telescopes. Nearby, a 140-footer is under construction, to be finished next year. Later, a 400-foot telescope of a new design will be added. And still later there may be a 2,000-foot monster.

A telescope's range goes up with its diameter. The 85-foot instrument now at work, Dr. Drake told me, should pick up messages from about 50 million million miles away, if they're being transmitted from equipment like the most powerful U. S. radars.

The 140-footer that's on the way will stretch that to 85 million million miles, the Sugar Grove telescope to 360 million million miles. It's impossible to comprehend such distances—although they are short by astronomers' standards.

The black boxes that sort out the wispy signals collected by the dish are far beyond a radio ham's most extravagant dreams.

The ultra-sensitive first-stage amplifier hangs in the air at the focus of the antenna reflector. It is the newly invented reactance amplifier. This will be replaced by the still more sensitive maser, which must be bathed in liquid helium (452 degrees below zero). To work with liquid helium in a bottle that is swinging around 100 feet off the ground will be no mean trick.

The rest of the amplifier fills racks in a building at the base of the antenna. Only in the newest secret military radars, costing many millions of dollars, do you find anything fancier. When the maser is installed, the telescope will be a million, million, million times more sensitive than your TV set.

Where to look. I asked Dr. Otto Struve, the famed Russian-born astronomer who is director of the Observatory, which nearby stars are likely homes for Intelligent Beings.

Dr. Struve figures that the odds come out this way:

Nearly half of all stars have to be washed out because they are twins or triplets; any planets around them would have irregular orbits swinging to extremes of heat and cold. Almost all the remaining stars probably have planets. And about a tenth of these stars are like

our sun: not too hot, not too cold, not likely to explode into supernovas, not likely to cool off rapidly.

Six of these promising stars lie within 90 million million miles from us. Within 600 million million miles are about 500 likely stars.

To start, Dr. Drake is aiming his telescope at two faint southern stars over 60 million million miles away, Tau Ceti and Epsilon Eridani. You can't see them at this time of year because they come above the U. S. horizon only in the afternoon. A radio telescope, however, can "see" stars in the daytime.

I asked Dr. Drake, "What will you do when—or if—you do get a real message?"

He replied: "First we'll just study it. We should be able to learn a lot from it about how advanced their technology is.

"Then we'll send a message back with all the power we can muster. We'll probably send back exactly the same message we receive—to tell Them how clearly They're getting through. I suppose the next thing we'd do would be to transmit a television pattern in their direction."

But how do we know that these far-off neighbors—if They actually exist—will be friendly? Maybe They seek out other civilizations only for destruction, to prevent competition.

Dr. Drake shrugged that off. "If They are advanced enough to destroy us, then They're advanced enough to detect our present radio and radar. They'll know we're here whether we send Them a reply or not."

And finally I asked: "Do you really think we'll find something?"

"I am quite sure," he said, "that eventually a signal will be received."

So what? When the message does come, it will be from a planet perhaps 50 light years away. It'll be a message that took 50 years to reach us. It'll take 50 years for our reply to reach Them. It will be a century from now before They can answer that.

So what difference does it make if a Ph.D. down in West Virginia hears beeps coming out of the sky?

Probably none, of any practical importance. It'll just be one of the most exciting things that ever happened in the history of the human race.

on winding, blacktop back roads established that the 300F has the stability to go with its performance.

It's big, and you don't throw it around corners like a little sports roadster, but it's sure-footed. The fat 9.00-by-14 nylon racing tires grip the road like a bulldog holding a bone, and there's no squeal of protest when you round a bend.

The chassis. The 300F has the familiar Chrysler suspension: torsion bars up front and wide-based leaf springs at back. The springs have a higher rate—they're stiffer—than standard Chryslers.

The stiff springs, the use of heavy-duty shock absorbers for better control, and the low center of gravity of the 55-inch-high 300F explain the car's fine handling.

The chassis modifications also explain the firmer-than-normal ride. The 300F doesn't float over the road with the billowy feel characteristic of most U. S. cars. It isn't uncomfortable or harsh, but you do "feel" more of the road than in the boulevard-ride jobs.

These latest 300s are a lot more comfortable than their ancestors. I drove the first 300 wheeled off the assembly line five years ago and it really let you know what the road was like under you. The ride smoothed out as speed climbed, until at 75 or 80 m.p.h. it felt comfortable and secure. This is true of the 300F to a degree, but the high-speed smoothness is less noticeable since the ride is so much better at lower speeds.

Traffic trouble. So ended the first day. Next morning I spent several hours driving in traffic of varying densities. This was a frustrating experience. It takes effort to keep that big engine on a leash. You can feel it straining to go.

I found, too, that fourth is not a good traffic gear; not with that 2.93 axle, anyway. The engine loafs at about 1,200 r.p.m. at 35 m.p.h., stumbles in protest when you kick the accelerator. Third is the gear for use for piddling around town under 40 m.p.h. Even in second, the virile V-8 hardly works up a sweat in traffic—and this is the gear for lively response.

First seems too low to me, and it would be more so with a lower (higher numerical) rear-axle ratio. Its 3.35:1 is more gear than this powerful car needs. Also,

since second gear is 1.96:1, engine revolutions drop off substantially in a first-to-second gear change.

You can hardly fault the four-speed gearbox otherwise. Shifts are smooth and easy. You can "row" back and forth between gears effortlessly, though I felt the lever could be closer to the driver. I've driven cars with shorter shift-lever throws, but not many. First-to-second and third-to-fourth shifts take seven inches of lever movement, second-to-third just a bit more.

Next morning I returned the car—reluctantly. I took up a short list of objections about the 300F with Bert Bouwkamp, one of the division's top engineers. Working on the 300 series is a labor of love with Bert and he's gone along with me on several tests of earlier cars in the series—including the first one.

Lowering the boom. I found that Bert and his boys had anticipated several of my objections. They plan to move the shift lever one inch back and two inches to the left on production models. They are going to add a crossover pipe in the exhaust system to cut out a loud booming that comes in at about 2,000 r.p.m. during part-throttle driving and to quiet the throaty thunder that comes out of the 2½-inch-diameter exhaust pipes when the throttle is cracked wide open.

(Actually I didn't mind the healthy exhaust sound; it suits this he-man automobile. But it does make the car pretty conspicuous and might draw frowns from the law.)

Bert agreed that first gear was on the low side and said they were considering a change for production models.

He also agreed that the tachometer location, in front of the center console, is not ideal. Nothing, however, can be done about this.

"We get just so much money to spend on these jobs, and we couldn't stretch this year's budget to include a new instrument panel. So we're using the standard Chrysler panel, and there's just no place in it to put the tach."

It's a minor flaw in what is a really impressive automobile. The 300F certainly isn't the most practical car on the road or one suited for family hacking service, but it sure is fun to drive.

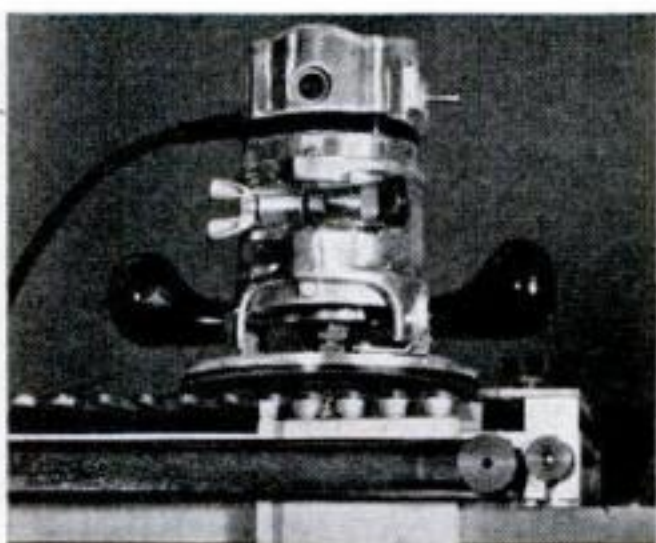
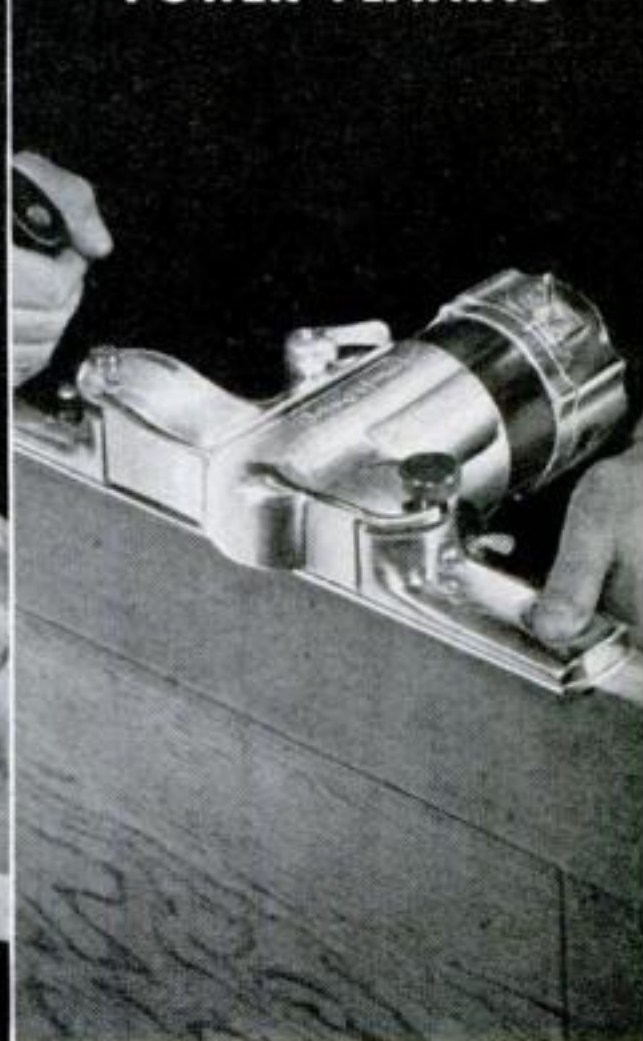
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Answers to

PS Puzzlers

on 20 and 22

Chain puzzle: He removes only one link—the third from the end. On the first day he gives the innkeeper that link. The next day he gives him the two-link segment and gets the one link back in change. The third day he gives him the one link again; the fourth day the four-link segment, getting three links back, etc.

Weights: The bottle weighs the same as five tumblers. Cleverer people can "see" the solution by mentally rearranging the scales. I did it algebraically, using "b" for the weight of the bottle, "t" for tumbler, "s" for saucer, and "p" for pitcher. You get three equations:

$$\begin{aligned} (1) \quad b + t &= p \\ (2) \quad b &= t + s \\ (3) \quad 2p &= 3s \end{aligned}$$

From (3) we get $p = 3/2 s$. From (2) $s = b - t$. Using (1) now, successive substitution yields:

$$b + t = 3/2 (b - t)$$

which finally reduces to $b = 5t$.

Logical puzzle: There are several logical paths to the end. Here's one:

The painter cannot be Fuller. By clue 1 the painter knows of both the carpenter and the plumber, and by 4 Fuller does *not* know Daw.

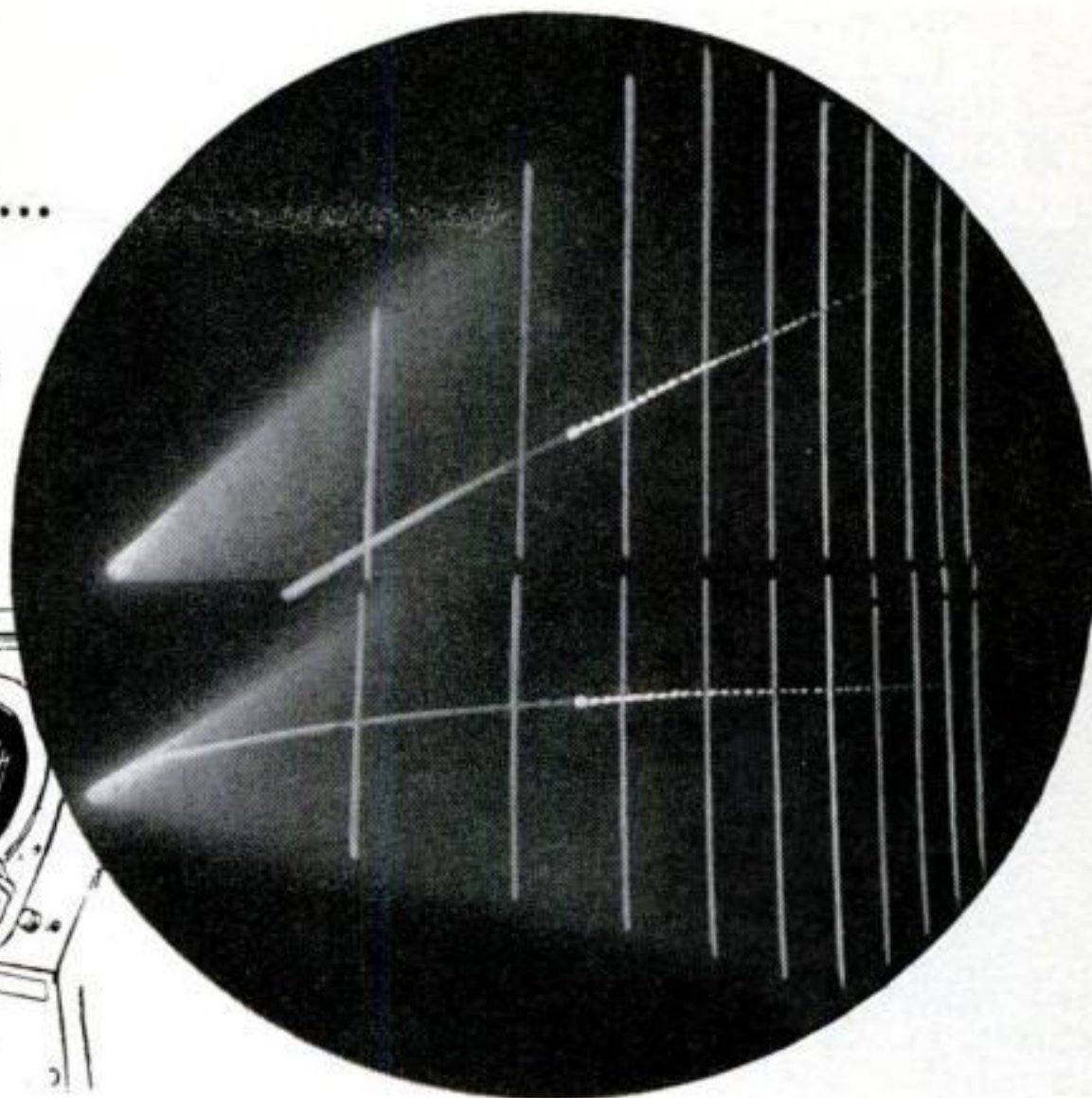
The painter cannot be Clark. If he were, then Fuller and Daw would stand in relation to each other as plumber-carpenter or vice-versa. But again by 4 we know Fuller never heard of Daw so there can't be any kind of worker-boss relationship between them.

The painter must then be Daw. Then the carpenter is either Fuller or Clark. If he's Fuller, the plumber must be Clark. But by 3 we know that Daw (the painter) makes more money than Clark, and by 2 we know the plumber makes more money than the painter. Therefore the plumber can't be Clark or we get a contradiction. The carpenter must then be Clark, and automatically the plumber is Fuller. Re-read each clue as a final check.

Anaximenes' experiment: Two factors are at work to make your palm feel cooler when you blow on it through pursed lips. One, probably the more significant, is that you simply blow harder. The increased wind velocity carries heat away faster. The other is the "Joule-Thomson effect": When a gas like air passes through a narrow opening like your pursed lips it's at a higher pressure than when it reaches the outside. As it goes from the higher pressure region to the lower, the air expands and cools.

Mechanical puzzle: The mercury that closes the circuit does so under the influence of gravity. Therefore the switches must be installed with a marked top. Far-sighted Lester thought the "top" mark was merely a scratch. In mounting six the wrong way, he did just a bit less well than normal probability: a 50-50 chance.

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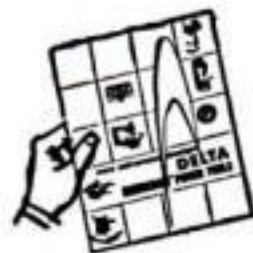
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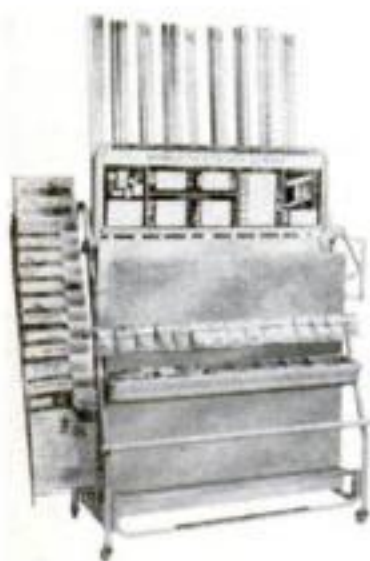


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America's Most Misunderstood Snake

[Continued from page 97]

They often grow more than seven feet long. Gopher snakes are at home throughout the length of the West Coast.

Man meets snake. One man who definitely does not share the general aversion to snakes is Charles E. Shaw, curator of reptiles at the San Diego Zoo.

Mr. Shaw met his first gopher snake in tall grass. He was about 21 at the time, and already fond of reptiles, but this encounter was unsettling.

"In fact," said Shaw, "I went right up in the air. This guy let loose with a loud hiss just as I was about to step on him. I hadn't seen him at all.

"But when I came down, I picked him up. And he didn't even offer to bite.

"They're like people," he continued. "There are tough ones, mild ones, and in-betweens. Most gopher snakes are quite tractable. They can be picked up and handled without much difficulty."

If you encounter a sour-tempered gopher snake that tries to bite you, let it bite, Shaw advises.

"It isn't any worse than a bunch of little pinpricks," he explained. "But if you jerk away from the snake, your skin is likely to get caught in its teeth and be badly torn."

That's because the gopher snake's needlelike teeth curve backward, like those of all snakes, to give it a firmer grip on whatever it is eating.

Another witness to the gopher snake's usual amiability toward people is Dr. James Anderson, research assistant in the Museum of Vertebrate Zoology at the University of California. "I've handled a great number of them in the wild," said Anderson, "and have never been bitten by one. Oh, a few have made bluff strikes, but with no intention of hurting me."

Anderson became acquainted with the genus *Pituophis* as a youngster. A frequent, fascinated visitor to the Newark (N. J.) Museum, he was allowed to feed and handle its one live pine snake, an ancient character named Piney.

"Piney would hiss and snort at me, but never bite," Anderson recalled. "And what an appetite that old boy had! One day I fed him three mice, a rat, and four chicken eggs."

Their yen for rodents is prodigious. One bull snake of medium size can kill

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America's Most Misunderstood Snake

all the gophers infesting an acre and a half of alfalfa, studies at the Kansas State Agricultural Experiment Station once revealed.

And if allowed to hunt without getting the axe, these snakes would keep the rural population of rats and mice well under control. The magnitude of this job can be better understood when you contemplate the dazzling fertility of mice. An authority has estimated that a single pair and its descendants, if permitted to breed unchecked, could bring more than a million mice into the world in a year.

Gentle and obliging as it may be with people, a gopher snake is a swift and terrible killer when loose among the small mammals.

"It isn't normally a fast mover," explained Dr. Anderson. "It'll lie where it scents mice—it has an acute sense of smell. But when a mouse comes along, the snake strikes so fast that the move is just a blur.

"Its favorite technique is to grab the creature head-on, around the snout, so it can't bite. Then it twists the mouse's head and throws a couple of coils around

its body, squeezing it to death. It can do all this in 60 seconds."

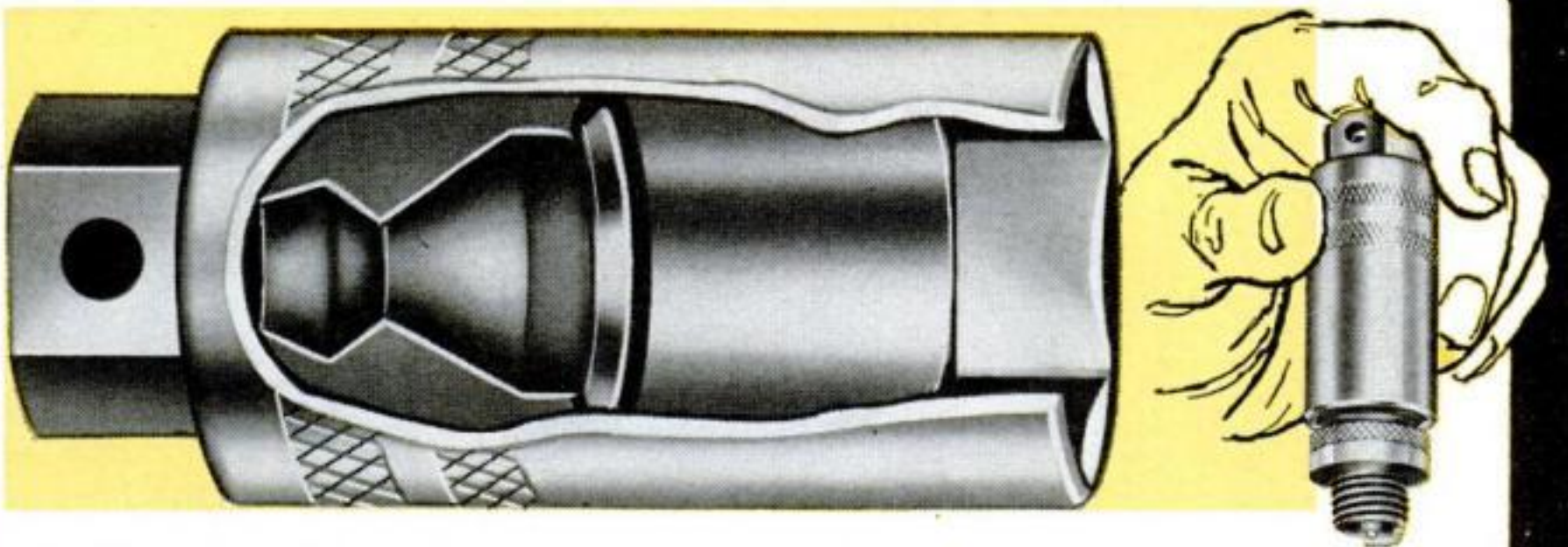
It tackles gophers the same way, but a gopher is not an easy victim. It is strong, and has wicked teeth and claws.

"I've seen many an old gopher snake all beat-up around the head from those teeth and claws," Dr. Anderson remarked.

They like it hot. Gopher snakes prefer to hunt by daylight and when the temperature is in the high eighties, he said. You'd never find one out if the air were cool—say, as low as 55 degrees. Their love for rodents lures them into barns, corncribs, grain bins, and woodpiles. They prefer to stay under things when they're not hunting. In winter, they hibernate in burrows and rock slides.

They can go for long periods without food, but they need water much more frequently, Dr. Anderson said.

This past year, an unusually dry one in the Far West, great numbers of gopher snakes met untimely deaths because thirst drove them out of fields and woods onto sprinkled lawns. There, of course, the congenial critters were usually mistaken for rattlers.

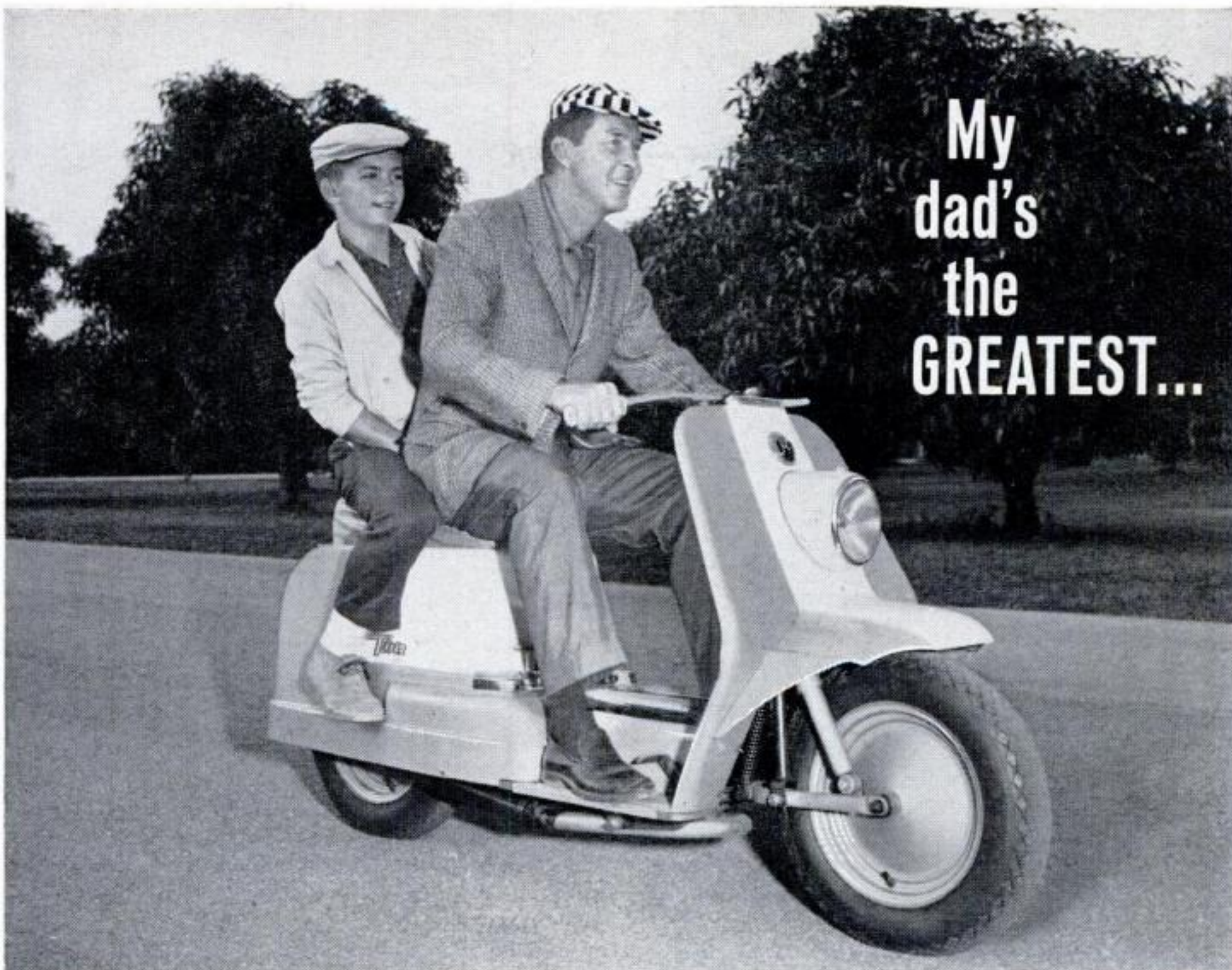


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War Between Burglars and Inventors

[Continued from page 94]

ceiver monitors the signal pulsed by its transmitter and takes notice of any untoward palpitations.

The first team to be widely used was a light-beam transmitter and a photoelectric receiver. Invisible infrared light is commonly used, to make it impossible for wary criminals to avoid the beam by seeing where it isn't. Multiple light sources or mirrors broaden the beam, so a thief can't crawl under or between the rays.

It is obviously important that a photoelectric burglar alarm detect—and reject—such phony substitutes as light sources brought along by a burglar. The infrared beam is therefore pulsed out at a special frequency. The receiver is tuned accordingly, so if the electric eye sees a steady glow, it acts just as if the beam had been interrupted. Some highly scientific criminals have tried to deceive the system by using portable strobe lights; they have discovered that the wrong frequency also sets off an alarm.

In some enclosed areas, broader protection than light beams is offered by unfocused waves that scatter to every corner of a room. Sound waves, which have this property, have been widely used recently. In some cases they are audible, but more often they operate in the silent—or ultrasonic—frequencies.

Sensitive receivers "listen" both to direct waves from ultrasonic transmitters and to the normal patterns of reflections. If an intruder larger than a cat or dog enters the room, his body changes the reflective path of the waves and sets up a beat note that a receiver promptly turns into an alarm.

Another eerie electronic gimmick, the capacity alarm, is now coming into wide use. It reacts to the mere approach of an intruder. If you ever tuned a regenerative receiver in the early days of radio, you'll recall how squawks from the set would change pitch when you reached for the dial. Your hand detuned the set by changing the capacitance of the unshielded circuit. An MIT man named Maxwell Lindsay first adapted this to burglar protection. His system surrounds a safe, filing cabinet, wire fence, or other metal surface with a capacitive field. Anything that upsets this field blows the whistle.



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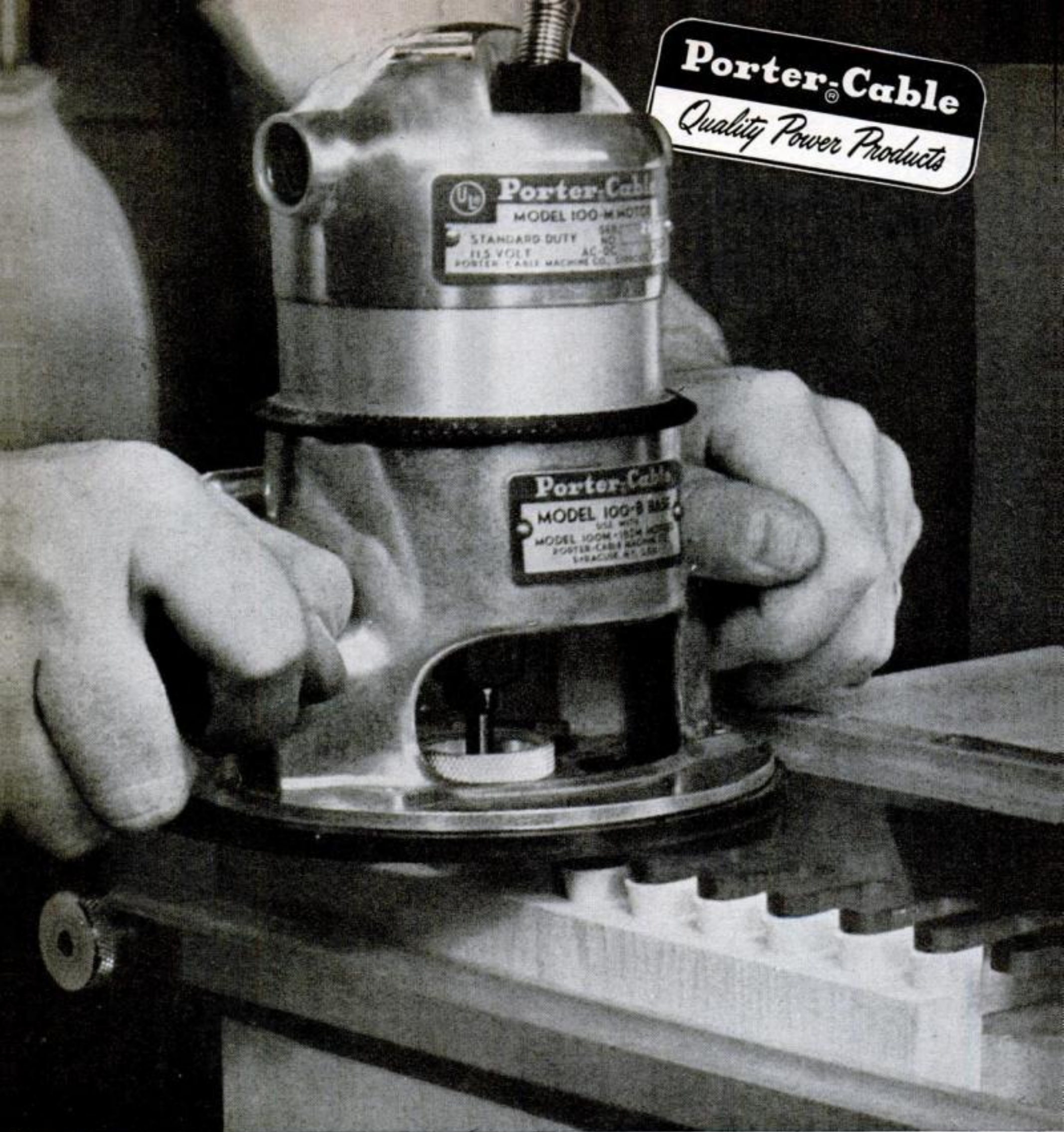
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War Between Burglars and Inventors

Capacity alarms on fences around plants and military installations are considered to be just about unbreachable, except, possibly, by tunneling. (One athletic burglar recently pole-vaulted over a fence without giving an alarm. But he broke his leg in landing and had to holler up some guards.)

Small animals and birds have created problems for fence alarms. Circuits are designed to tolerate small changes so they won't normally react to individual roosting birds, or even to a considerable number who arrive one at a time. But if a bevy of birds suddenly departs at one time—perhaps as a result of a car back-firing—the capacity of a system may be changed enough to give an alarm. Fortunately, birds always roost at the top of a fence, so a dummy perching wire above the protected screen can handle this.

Too many false alarms. A peculiar problem of electronic—and some electric—burglar traps is not that they miss many intruders, but rather that they may spot too many. Extreme sensitivity is a serious problem.

A signal system has little value unless there is a follow-up for every alarm. False alarms are expensive. And if there are too many of them, thieves may be able to sneak in while guards are busy chasing wild geese. Thus vibration detectors can't be used in places where they may be set off, say, by passing trucks. Microphones are up against similar restrictions. (In burglar-alarm systems they don't eavesdrop on conversations but only respond to a rise in sound level.) Like vibration signals, mikes are standard in vaults and similar enclosures. But in more exposed locations they are prey to random noises. In the Library of Congress, for instance, they failed to distinguish between burglars and literary—but noisy—rats. At least one factory had to take out its microphones after jet planes started using a nearby airfield.

False alarms caused by oversensitivity often take a bit of tracking. One jewelry store had a capacity system installed on its safe. It worked fine for a while until it began turning in false alarms every Saturday night at nine. Investigators discovered that the safe backed up against the wall of an alley shared by a ladies' hat shop. Further snooping disclosed that

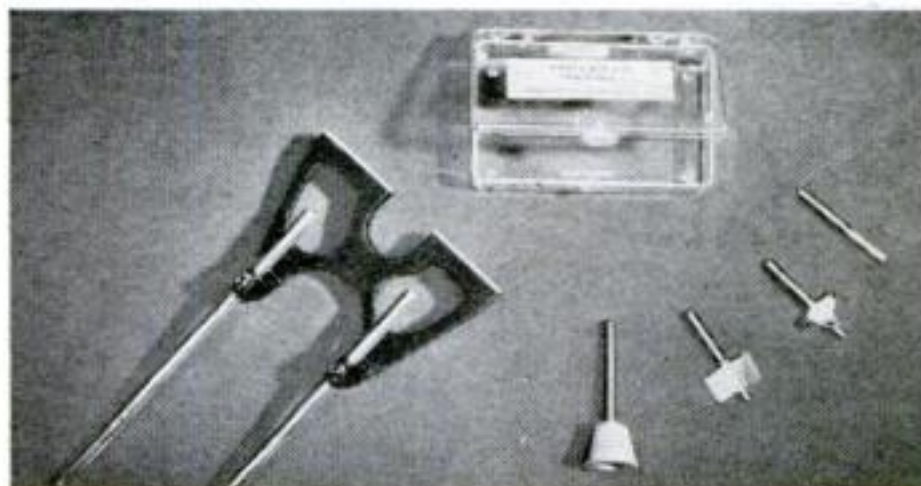
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War Between Burglars and Inventors

a salesgirl in the late-closing hat shop had recently acquired a new beau who called for her every Saturday night. While he waited—in the alley—he would lean against the jewelry-store wall and smoke a cigarette. Rather than disrupt the romance, the protection agency installed a shield between safe and wall.

The more basic alarm devices—such as door switches—also impose some restrictions on the people and property they

.....

Burglars in Your House?

Next Month: Based on interviews with more than 100 convicted burglars, here's the inside story on how they gain entry, what they're looking for, what you should do if you hear one in your house at night—and how to keep them out in the first place.

.....

guard. Any opening of a door—even by an authorized person using a key—shows up as an alarm. It is customary for electric protection services to work out time schedules with their clients. If a store is scheduled to be opened, say, at 7:58 in the morning, the owner had better check his watch. Even a couple of minutes off in timing will bring a patrol.

When timing counts. Scheduled openings and closings may protect against holdup as well as burglary. Some specialist robbers, known in the trade as “morning glories,” kidnap the manager of a business on his way to work and force him to open both the door and the safe. If he wants to call for assistance—without actually resisting his captors—the victim only has to make a slight timing “error.” Other tricky dodges can be used, such as locks that can be opened by either of two keys. But one sends an alarm.

Rigid time schedules apply also at night. Absent-minded storekeepers are constantly being nabbed when, after locking up, they go back for an umbrella. In one of the most notable “catches” credited to electric protection, former President Truman stored some documents in a Kansas City courthouse. Then, forgetting the security system which he had had installed, he stopped in one summer evening to look over some papers—and shortly found himself facing police guns.

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New Shift Uses Magnetic Clutches

[Continued from page 124]

U. S. automatics have relatively simple "brains." Their control systems consist of valves and hydraulic lines. Oil pressure tells the gears what to do and when.

U. S. automatics have built-in insurance against roughness. The Hydra-Matic cushions the action of its mechanical bands and clutches with a "fluid clutch" interposed between engine crankshaft and drive train. U. S. torque converters are, themselves, a cushion between engine and gearbox.

The Rootes automatic transmission makes U. S. varieties look as uncomplicated as a belt-driven lawn mower. It has, to begin with, not one coil to freeze the iron powder—called a "magnetic-powder coupling"—but two. Matching the coils are two couplings—the first connected directly to the main drive shaft, the second connected indirectly through constant-mesh gears.

In place of the hydraulic fluid, Rootes uses a series of switches and solenoids.

The Rootes governor works on the principle of an electrically energized speedometer. Since it runs off the drive shaft, it reports road speed. What would serve as the pointer on a speedometer travels between two stops. The stops are electrical contacts. When the pointer touches one of the stops, a circuit is closed and the gears shift. Shift points are, therefore, determined by road speed, but only in part.

The governor has to be sensitive to the throttle opening because the driver may want to delay an upshift for faster acceleration. So a gear train is built between the accelerator and governor to retard the position of the stops. Hence, at hard accelerator pressure, the pointer must travel farther—which is to say, the road speed will be higher—to reach its electrical contact for intermediate or high gear.

That isn't all. In decelerating, downshifts have to occur at lower speeds than the upshifts. Otherwise the car would be shifting gears constantly with small changes in throttle or road speeds. So small "hysteresis," or delay, magnets are attached to the pointer and the stops to further delay the upshift points. That makes them occur at speeds higher than those for downshifting.

Nor is that all. Intermediate gear free-

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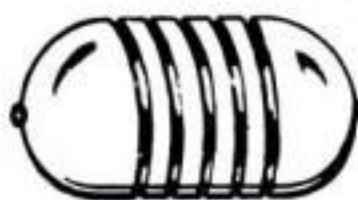
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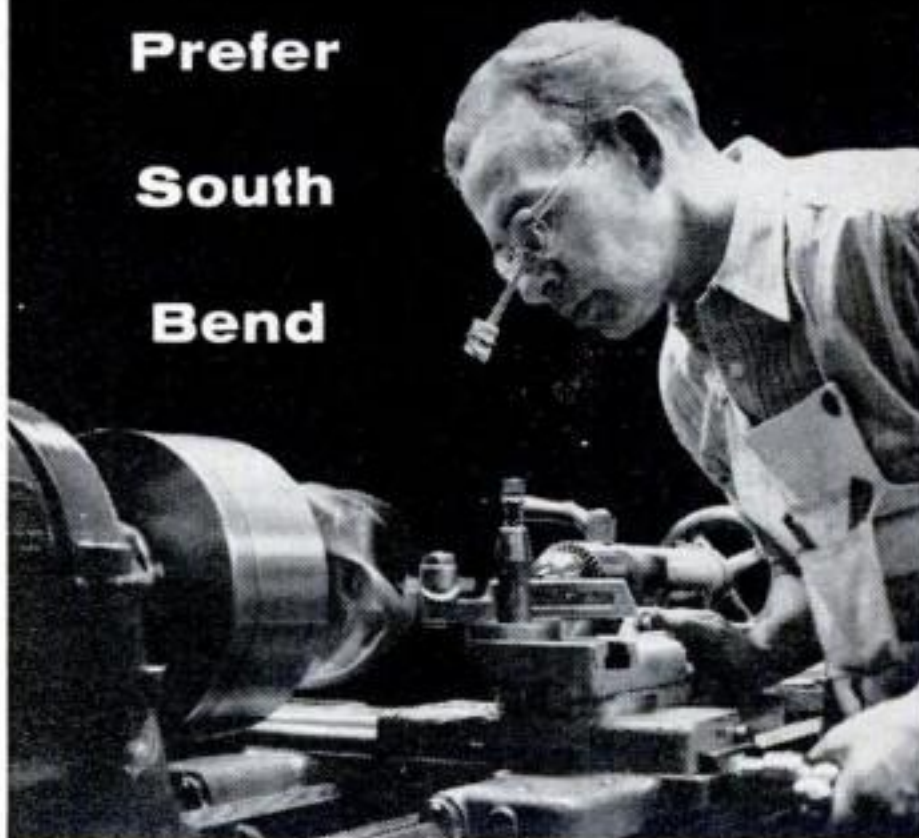


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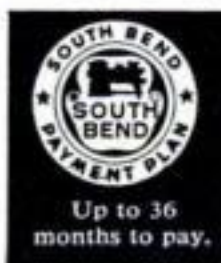
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New Shift Uses Magnetic Clutches

rotates on the main drive shaft. A "dog clutch" on the shaft has to engage it as the transmission upshifts from low. To bring intermediate into play, the first magnetic-powder coupling has to be energized to put a momentary drag on the engine, and therefore on the main drive shaft. This is solely to synchronize the dog clutch with the shaft. A sensing element called a balk ring prevents the dog clutch from engaging until this synchronization occurs. As the dog clutch engages, the magnetic coupling releases.

Nor is *that* all. When a driver tromps on the gas pedal for more torque and the transmission downshifts from high to intermediate, the direct coupling is released and the engine naturally speeds up to synchronize drive shaft and dog clutch. To downshift manually to intermediate while in direct drive, a throttle solenoid controlling the butterfly comes into play. It speeds up the engine and synchronizes dog clutch and drive shaft.

Then there's the downshift to low gear. The dog clutch must release its grip on intermediate. It won't respond until the torque is off the shaft. So the coil to the second magnetic coupling is denied juice for a twinkling. This releases the torque. The dog clutch lets go.

A mechanical linkage from selector lever to gearbox takes care of reverse.

This impressive power chain has its cushions. The built-in delays constitute some of them. So do the switches, such as that for synchronizing the dog clutch and the main shaft. There is a natural cushion, too—juice for the operation comes directly from the generator up to and halfway through intermediate gear. Since generator output varies with engine speed, the voltage fed to the coils is low at the start. This causes some slip in the indirect-drive magnetic coupling. When the drive moves into intermediate gear and high, the battery supplies the current.

To make the system "fail safe," there is a master electrical plug at the base of the steering column. If the transmission refuses to function, you remove the plug, reverse it, and reinsert it. The transmission now works on battery current alone. Position "2" now engages low gear and "D" direct drive. There is no intermediate. The car can be driven as much as 300 miles this way to a repair shop.

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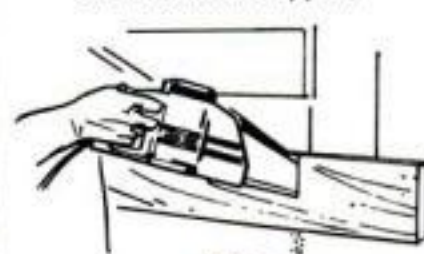
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Here Come Midget Diesels

[Continued from page 112]

cylinder without an auxiliary blower. It does this simply and efficiently with the aid of an extra internal part, an auxiliary charging piston, linked to one of the two prime pistons through its crankshaft. This charging piston provides extra crankcase compression.

The principle was conceived and patented by a German inventor named Dr. Herbert Venediger. But he had only the ideas, not the engine. The job of designing it for its various uses has been done largely by an earnest young Hungarian, Kristof Somhegyi, assistant chief engineer at American Marc.

The engine utilizes aluminum for just about everything but its power train. The block, crankcase, pistons, cover, and auxiliary-drive case, where needed, are made of the light metal. The cylinder heads are aluminum, with steel inserts, and American Marc is now trying out aluminum cylinder barrels, with thin steel liners.

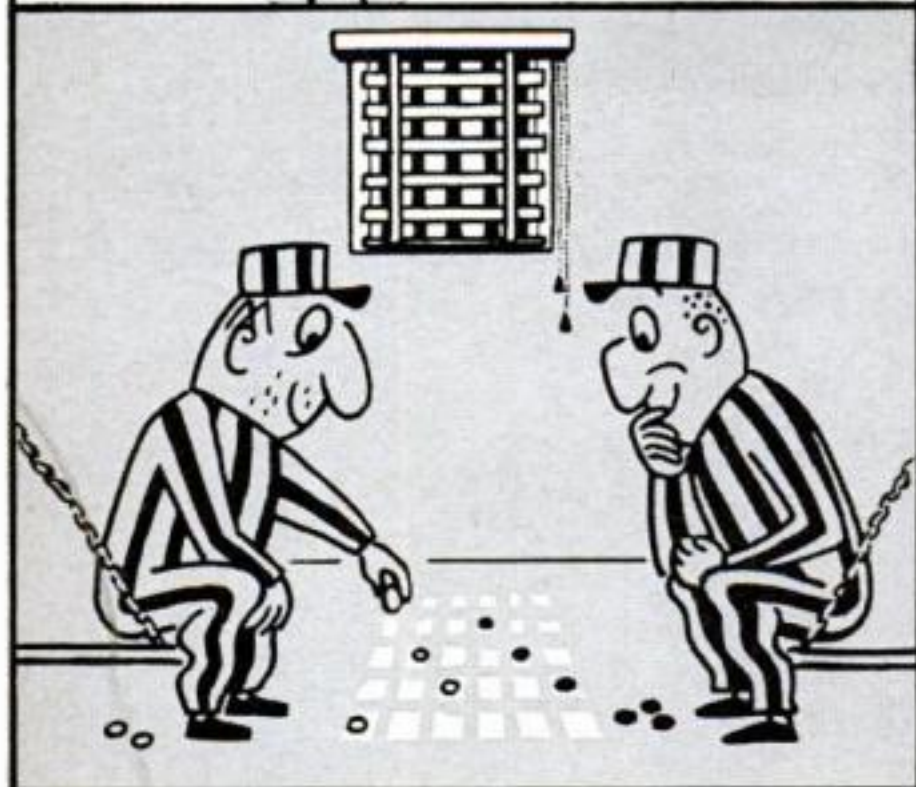
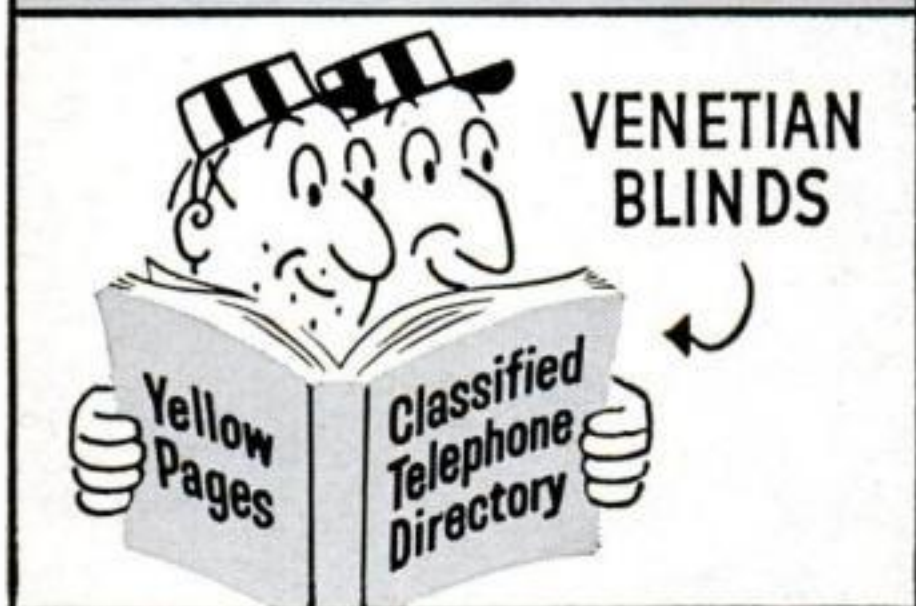
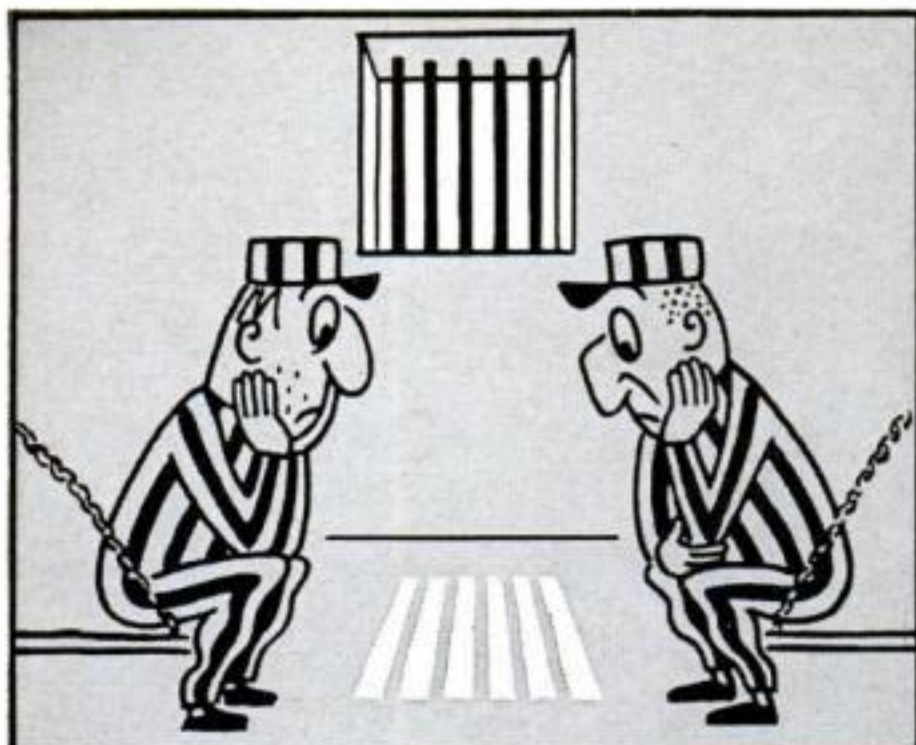
Man of action. Venediger's ideas might still be reposing on paper instead of doing revolutionary work in metal if it hadn't been for W. Denis Kendall, a remarkable Englishman who has been carrying a torch for little diesels since 1942. He founded and is president of American Marc, Inc., and he is as uncommon as his product.

Kendall, 56, a handsome, gray-haired man with youthful face, physique, and vigor, has been taking bold, dramatic risks since he was 14. At that age, he ran away to sea from his home in Yorkshire, England.

His career after that was varied. He jumped ship in Philadelphia to enter the United States illegally. He tested cars for General Motors briefly, learned about engines and manufacturing during stints at Budd, Citroen, and Hispano-Suiza. He managed an aircraft and antiaircraft gun plant in England during the war. He was a member of Parliament for eight years.

He built his first lightweight diesel in 1942—and has been hooked ever since. Wartime restrictions made it impossible to produce them then. Later, he was unable to talk his employers into building small diesels.

Even Mack Truck, where Kendall went to work after returning to the U. S. and



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Here Come Midget Diesels

where he ultimately worked up to a vice presidency, wasn't interested.

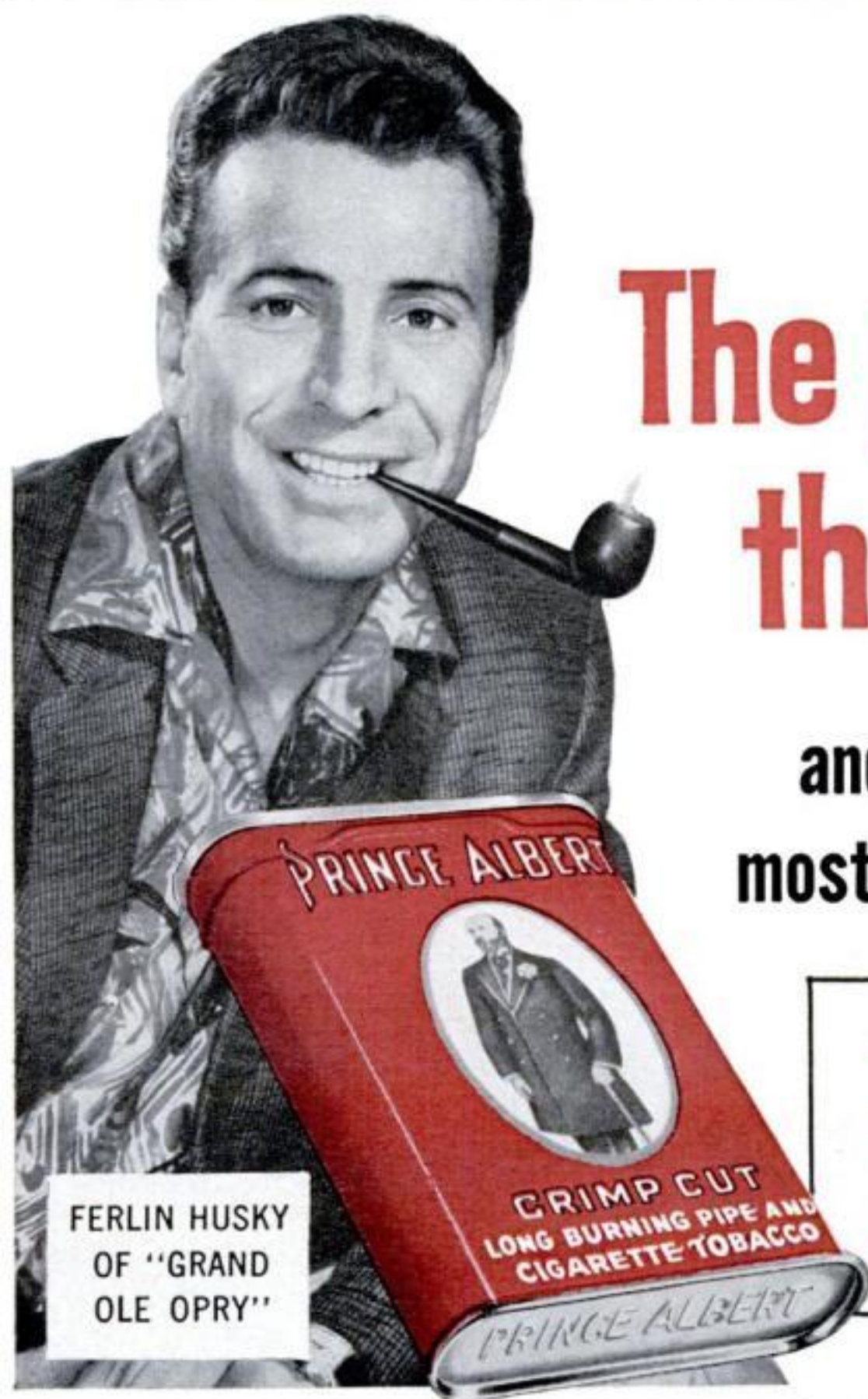
So Kendall started his own company. It was rough at first, but American Marc eventually won a Defense Dept. contract to build baby diesels for radio generators. Now he reports 40,000 outboard orders on the books.

Bigger boom ahead? But this is only a modest sample of the small-diesel boom Kendall expects. He foresees the little engines being used to run refrigerating plants in railroad cars and trucks, light-

ing plants on offshore drilling rigs, telephone and radio microwave systems, crop sprayers, irrigation pumps, farm cultivators, tractors, pickup trucks, and taxis.

But not passenger cars, he thinks—diesels are too noisy.

Kendall sums up his sunny outlook this way: "When users of internal-combustion engines realize the enormous savings in maintenance, operation, and longevity of diesel engines, there'll be no limit to the size of the market."



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Here Come Turnpike Trains

[Continued from page 63]

cold outside," he said. "Oil pressure has jumped from 60 to 70." A flurry of snow blew past. "If we get ice," he added, "we'll cut in the twin-screw drive. We're now running normal, with two axles driving us. That's eight wheels. When it ices up, or for heavy pulling in snow, we can flip this twin-screw lever and lock both differentials. It gives positive traction even when one side is on ice. We have sanders, too."

The sky ahead blackened. "Don't like the looks," Leroy said.

We had come nearly 500 miles and I had yet to feel any uneasiness in this train. I'd wondered how it would be passing other trucks or cars.

"Couple of little things we've got to watch," Leroy said. "Law requires us to pass with enough speed to complete the pass in one mile. The other thing to watch is drivers who try to help you back in line by blinking their headlights when you get ahead. A lot of them don't expect to see a second trailer. They blink you in as soon as the first box passes—and are surprised as hell when a second box comes along. You have to allow for that."

Minor complaints. From the escort car I'd noted one possible source of trouble in the road-train operation. Once a car overtaking the train prepared to cut in ahead of the rear trailer, evidently thinking it was two separate trucks. More lights on the trailer sides would cure that. Another thing was the blind spot close behind the rear trailer. From the cab, we couldn't see cars within 100 feet of our rear. Mirrors on the last trailer, feeding into the cab mirror, could help.

"Look at *that!*" exclaimed Leroy. A snow-plastered truck came toward us. We were entering the Lake Erie blizzard belt, already two hours late. Snow began to fall heavily. We felt the wind tugging the trailers.

"Our speed is dropping," Leroy said. "Down to 42." He glanced at the fuel gauge. It said 1/4 full. "I don't trust those things," he said. "They show lots of fuel, then suddenly they're empty. Usually we get five miles per gallon. Not getting over 3 1/4 now."

At the Thruway's milepost 437 a great snowburst blotted out the world. "Getting near home," Leroy said. "We can expect



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Here Come Turnpike Trains

anything now." He looked in his mirror. "Somebody getting a free ride back there." A red "single" from Pennsylvania was tailgating us.

"That's no good," Leroy said. He down-shifted to ninth. The big diesel sang a higher note. Soon the red single was 200 yards back.

"Look what that did to us," Leroy said. Our water-temperature gauge had shot up to 200 degrees. Just as suddenly it sank down to 180, though the engine was still pulling hard.

"What cooled it?"

"Automatic shutter opened on the radiator. Air-operated."

When the fuel runs out. By midafternoon, with the snow thickening and the wind a full gale off Lake Erie, Leroy was watching for slick spots. "These rigs came through all kinds of bad weather in last winter's tests," he said. "With 34 wheels on the road, we have better stability than other rigs. I wouldn't want a bad slide, however. You *could* double-jackknife."

Fifteen miles to go. Leroy, frowning, was watching the fuel gauge. He said: "If we don't get some relief from this wind . . ." At 3:40, he said, "Oh-oh. She's quitting."

We lost speed. Our big train had run out of fuel. Leroy steered her toward a safe shoulder, well off the pike. The engine was still running, but there was a long hill ahead.

"Better to stop here. If you run too long like this you pull up water and dirt from the bottom of the tanks."

A sign over the windshield read: **IDLE ENGINE THREE MINUTES BEFORE SHUTTING OFF.** We had fuel to do it. Then Leroy shut her down. Bitter cold crept into the cab.

The escort car came out of the storm. Steve went off in the car for fuel. He was gone a long time. The wind roared at us. Dark came down. Leroy had put out flares.

The car came back with 10 gallons of diesel fuel. Shaking with cold, we put five in each tank. But No. 7003 wouldn't start. Near-zero cold had done its work. Leroy worked the priming pump while Steve held the starter switch on. Nothing happened.

"Try the glow-plug circuit," suggested

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Here Come Turnpike Trains

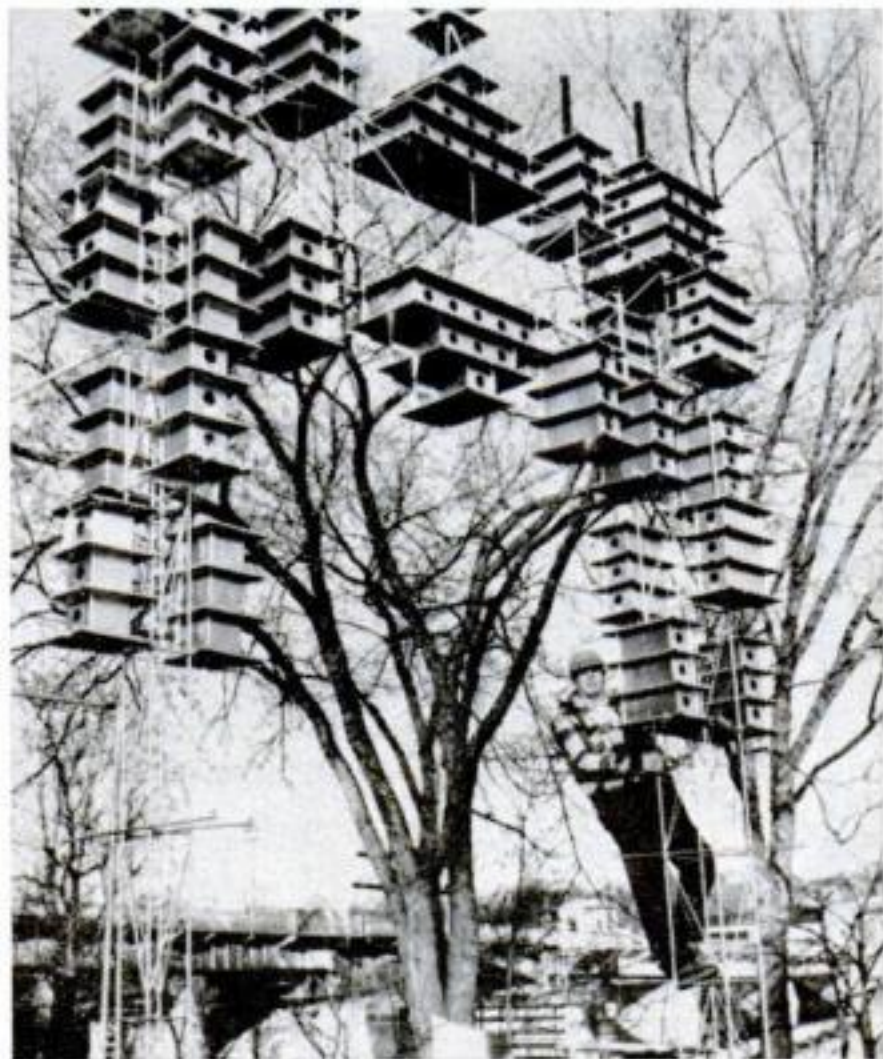
Steve. Leroy flicked a switch. In a moment a red bull's-eye lighted up on the dash. The glow plug had warmed the manifold. Then the big diesel took with a roar and we went on.

Journey's end. Ripley exit was a tumult of wind and snow. Our headlights showed only a few feet ahead. We paid our toll—10 cents a mile, double the normal truck charges. One mile farther we pulled off and No. 7003 stopped with a weary sigh of air brakes.

Here we would drop the trailer for Detroit. Another WX tractor later tonight would relay it to Toledo, where another truck line would pick it up and deliver it to Detroit. We would also drop the lead trailer, to be taken into Cleveland by still another tractor.

When I last saw Steve and Leroy they were trying to thaw out a frozen air-line connection, so they could disconnect the kite. They'd lighted a red flare and were using it for heat. No. 7003 stood there thrumming, her four headlights boring into the blizzard, waiting to start east again for Boston.

END



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How to Make Electronic Music

[Continued from page 186]

Filters that cut off or exaggerate certain frequencies are standard items in a sound engineer's bag of tricks. You can get similar results by using the tone controls on a hi-fi amplifier. The more times you feed the sound through, the greater the effect. For example, try recording the sound of an automobile engine through the amplifier with the treble boost at maximum and bass at minimum. Play back through the amplifier set the same way and make a new tape. This can be repeated as many times as you wish; each trip through will exaggerate the effect. You can wind up with the engine sounding like a Swiss watch.

Contact pickup will give you an entirely different sound than you'll get with a mike. One way is to buy an old microphone capsule and tape it to the body of the sound producer you want to record. The pickup cartridge on your phonograph will also work. Just let the needle rest on any convenient part of the object to be recorded.

Put them all together. When you have collected a sizable number of individual effects on tape, you'll need to borrow or rent a second recorder to make your master tape. Arrange the setup as shown in the last sketch. The sound fragments you have chosen to include are played on one machine while the other makes the master. Sounds from other sources can be fed in as needed.

It will probably take several tries before you get a sequence that seems just right to you. As a starter, the order could be as follows: an attention-commanding start with a loud percussive tone in reverse, the abrupt cutoff followed without pause by an echo effect. Then musical and speech sounds subjected to extreme pitch variations with occasional echo. Now a moment of silence, followed by percussive tones played the right way around. Introduce the loop—this could be a quiet rhythmic background with a bold theme added by superposition. With some care, one sound can be counterpoint to the other. Now you can repeat with variations—turn the sequence inside-out, the wrong way around, or in different order. It takes patience, but if you are inventive, you can produce a five-minute composition with just these elements.

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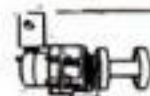
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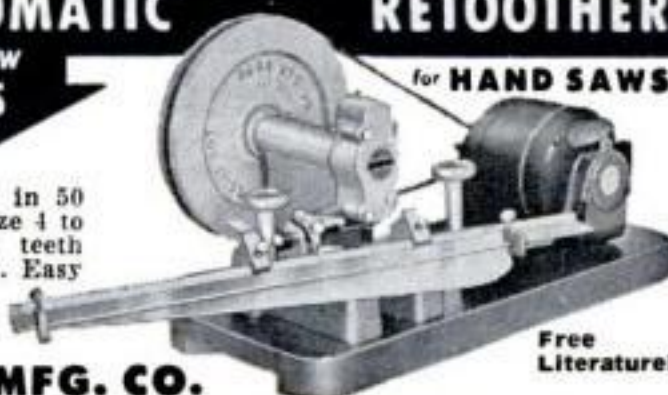
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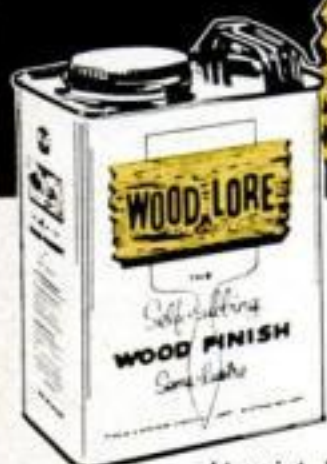


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7 Ways to Build a Garden Walk

[Continued from page 160]

If you know where you want your walk, you can let the soil serve as a form for your steppingstones. Dig round or irregular-shaped holes at least 10" in diameter and 2" deep. Fill these with concrete and trowel the surface.

An interesting and low-cost concrete walk can be made by pouring only 2" of concrete over 1" of sand, cinders, or fine gravel. The trick is to divide the walk into separate segments by inserting wood cross strips every 2' or 3'. These allow the concrete slabs to heave without cracking. In spring, they'll settle back into place when the ground thaws.

4 Asphalt is less well known, but is long-wearing, medium-priced, and takes less work than a solid-concrete walk.

The hot-mix type of road asphalt is not recommended for do-it-yourself installation, but two other kinds are easy to use. These are liquid asphaltic emulsion and packaged asphalt mix.

The packaged mix comes in convenient bags and can be put down directly over hard-packed earth. Rake the mix out to about a 2" layer, then compress it firmly with a lawn roller.

The liquid asphaltic emulsion is cheaper, but requires a stone base. Lay out one-by-six form boards and fill them first with a 4" layer of 1"-to-1 1/2" crushed stone, then a 1" top layer of 1/2"-to-3/4" stone. Roll this firm, then sprinkle on the asphalt.

You can spread the asphalt with an ordinary garden watering can. Flow it on thickly enough so it just begins to puddle. Let it stand several hours, then dust fine sand over the top and roll it with a lawn roller. Wash out your sprinkling can immediately with water and the asphalt won't stick to it.

5 Loose stones and other aggregates offer many vivid colors and textures. Crushed rock 3/8" to 1/2" in size is available from roofing and gravel dealers. White marble chips are one of the most striking, though expensive stones. Others come bluish, reddish, brownish, and gray. The cheapest is dark-gray gravel.

Because of their small size, crushed stones are best edged with wood strips or bricks to keep them from scattering. Put them down 1 1/2" to 2" thick over soft

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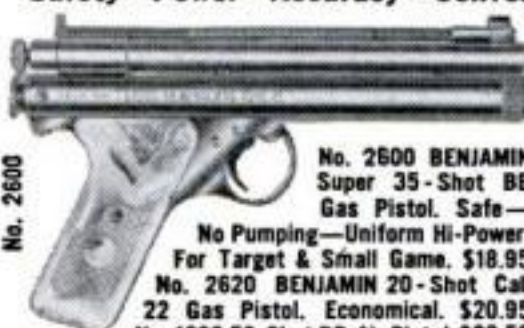
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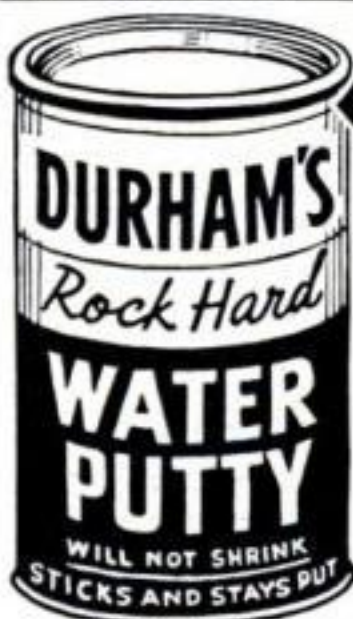
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7 Ways to Build a Garden Walk
earth, 1" thick if the ground is hard and stable. A cubic yard will cover about 100 square feet 2" thick. Prices run from \$3 to \$10 a cubic yard.

Pebbles or other larger crushed rock 1" to 2" in size do not scatter as easily as fine aggregates and can be edged merely with a border of bigger stones. Decomposed granite or rock dust will pack into a very hard walk.

Oyster shells sound exotic, but are available at many feed stores for about \$1 a 100 pounds. They give you a very soft, shimmering white walk. A bag will cover 25 feet of walk 20" wide and 1" deep. Use a base of sand or cinders at least 2" thick under the shells. As with bricks, be sure to treat the soil with a strong weed killer before putting down any kind of aggregate walk.

6 Wood, although the least permanent of walk materials, fits the character of a garden very well. The longest-wearing types are redwood, cedar, and cypress, but others will do. They should be treated with a preservative that contains a toxic agent to discourage termites.

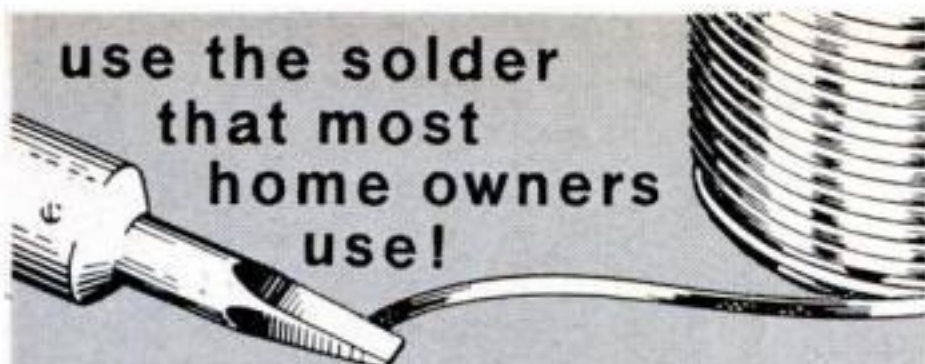
Slabs of wood 2" or thicker can be set in sand or soil for a quick walk. Discarded railroad ties, sliced into blocks, make the most lasting wood walk.

You can even set wood in concrete if you want a solid walk. In this case, be sure the bottom of the wood rests on gravel, not cement. Wood will last longer if water is free to drain away.

7 Soil-cement may seem a little on the odd-ball side, but if your soil is sandy or loamy and free of trash, you can get yourself a garden walk merely by adding portland cement.

Break up the soil 6" deep. Use form boards at the sides. Rake cement into the soil evenly. Figure the amount you need as one part cement to nine parts soil. One bag of cement will thus take care of about 9' of walk 2' wide.

Tamp the soil-cement mixture level and spray it with a fine mist of water until it is thoroughly soaked. Roll the surface as soon as it's dry enough not to stick to the roller. When it's hard enough not to show footprints, spray it again and repeat the sprinkling several times a day for a week to cure your walk thoroughly.



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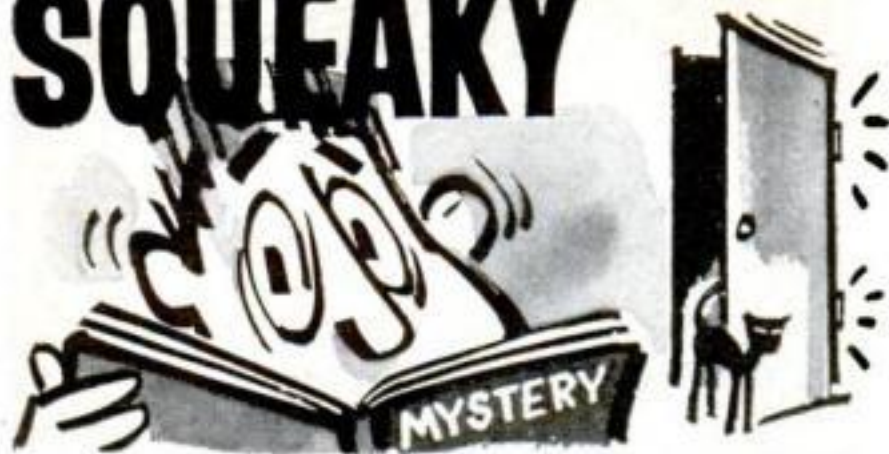
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MONEY BACK GUARANTEE



FREE LITERATURE

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Tornadoes: Giant Electric Machines

[Continued from page 102]

Something like Montgomery's luminous band must have been seen by John Stevens of Silverton, Tex., in a 1957 tornado there. Out in his car, he had driven beneath a filling-station canopy for protection from hailstones that reached almost baseball size. Looking south about 10:35 p.m., he saw the tornado as a ring of light about five blocks away. The luminous circle seemed to him 40 or 50 feet in diameter, and an equal height above the ground. When the tornado had gone by, a strong odor remained, "like that around electrical equipment."

Rain of fire. A tornado spouted "fire balls" near Rock Rapids, Iowa, in 1932. "From the sides of the boiling dust-laden cloud, a fiery stream poured out, breaking into spheres," according to the eyewitness testimony of George Reveling of the U. S. Weather Bureau.

After a tornado passed over a golf course at Fargo, N. D., in 1957, reported Lloyd J. Byers, he found holes of six-inch to two-foot diameter in the ground—and a four-foot strip of turf rolled up into a ball. Putting his arm into one hole up to his shoulder, he could not touch bottom. Seared grass around the holes suggested that they were dug by tornado lightning, which must have been of extreme intensity.

From 100-mile distance, one of the Cambridge scientists himself noted the incessant lightning of the giant electrical storm of June 9, 1953, that produced the Worcester, Mass., tornado and two others. Electric-field meters directly beneath superelectrical storms, near tornado paths, have actually tallied 10 to 20 lightning strokes a second.

All the evidence adds up to indicate that electrical phenomena, taking place on an awesome scale, play a key role in the mechanics of a tornado.

A major mystery remains to be solved: What kind of an electrical machine is a tornado? Does it act as a mighty natural generator, to produce its lightning and other electrical effects? Or, conversely, is a giant storm's electricity the motive force that sets a tornado whirling? When experts learn the answer—perhaps with the help of firsthand observations like those reported here—we may be nearer to conquering the twisters' menace.

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